SAP Worksheet #1 – Title and Approval Page

Base Realignment and Closure
Program Management Office West
San Diego, California

DRAFT FINAL
Parcel B Removal Site Evaluation Sampling and Analysis Plan

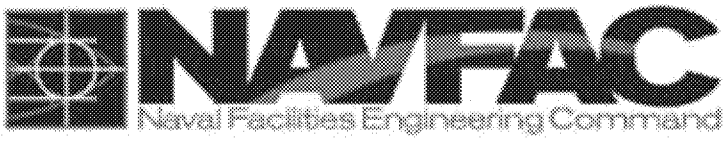
Former Hunter's Point Naval Shipyard
San Francisco, California
~~March~~May~~December~~ 2021~~0~~

DCN: GLBN-0005-5364-0003

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:
Gilbane Federal
1655 Grant Street, Suite 1200
Concord, California 94520
Contract Number: N62473-17-D-0005, Task Order N6247318F5364



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Signature Quality Assurance Manager, Gilbane	Date
Signature Program Chemist, Gilbane	Date
Signature Quality Assurance Officer, U.S. Navy	Date

EXECUTIVE SUMMARY

This document presents the Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP) for the radiological investigation at Parcel B at Hunters Point Naval Shipyard (HPNS), located in San Francisco, California. This document was prepared in accordance with the Department of the Navy's (Navy's) UFP-SAP policy guidance to help ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable of intended uses. The laboratory information cited in this SAP is specific to ARS Aleut Analytical, LLC of Port Allen Louisiana, EMAX Laboratories of Torrance, California, and A&B Environmental Services of Houston, Texas. If additional laboratory services are requested requiring modification to this SAP, revised SAP worksheets will be submitted to the Navy for approval.

Sites that will be addressed under this SAP include former radiologically impacted areas in Parcel B, which occupies 59 acres in the northern portion of HPNS (**Figure 1-1**). Radiological surveys and remediation were previously conducted at former HPNS as part of a basewide Time-critical Removal Action (TCRA). Tetra Tech EC, Inc. (TtEC), under contracts with the Department of the Navy (Navy), conducted a large portion of the basewide TCRA, including Parcel B. Data manipulation and falsification were committed by TtEC employees during the TCRA. An independent third-party evaluation of previous data identified potential manipulation, falsification, and data quality issues with data collected (Navy, 2017, 2018). As a result, the Navy will conduct investigations at radiologically impacted soil and building sites in Parcel B that were surveyed by TtEC. Future or concurrent SAPs will address soil and buildings in the other parcels (C, D-2, E, UC-1, UC-2, and UC-3), including the North Pier and Ship Berths.

The purpose of the investigation presented in this SAP is to determine whether current site conditions are compliant with the remedial action objective (RAO) in the *Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009). The RAO for radiologically impacted soil and structures is to prevent receptor exposure to radionuclides of concern (ROCs) in at concentrations that exceed remediation goals (RGs) for all potentially complete exposure pathways. ~~Additional reference background areas (RBAs) will also be identified to confirm, or update as necessary, estimates of naturally occurring and man-made background levels for ROCs not attributed to Naval operations at HPNS. A statistical comparison of site data to applicable reference area data will be conducted.~~

The sampling and analysis activities at Parcel B will be conducted in accordance with this SAP, the separate Parcel B Work Plan, and a separate accident preventions plan/site safety and health plan (APP/SSHP). Project requirements, including personnel roles and responsibilities, required training, and health and safety protocols are based on Gilbane Federal (Gilbane) and its subcontractor, Envirachem, leading and conducting the field activities. If another contractor performs the field activities, this SAP will be amended with contractor-specific information, as needed.

Scope

The radiological investigation will be conducted at the following sites within Parcel B:

- Former Sanitary Sewer and Storm Drain Trenches
- Building 103
- Building 113
- Building 113A
- Former Building 114
- Building 130
- Building 140
- Former Building 142
- Building 146
- Former Building 157

Soil Investigations
Soil investigations will be conducted in a phased approach at the following areas in Parcel B:

- Former sanitary sewer and storm drain Trenches
- Former building sites and surface soil associated with existing buildings

Soil investigation areas will be divided into trench units (TUs) and surface soil survey units (SUs). The sizes and boundaries of the TUs and SUs will be based on the previous plans and reports.

Former Sanitary Sewer and Storm Drain Trench Units
For the TUs associated with former sanitary sewers and storm drains, a phased investigation approach was designed based on a proposal by the regulatory agencies to achieve a high level of confidence that the Parcel B ROD RAO has been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 33 percent of TUs in Parcel B. Soil sampling at the remaining 67 percent of TUs will be performed as part of Phase 2 to increase confidence that current site conditions comply with the Parcel B ROD RAO. The Navy will re-excavate 100 percent of Phase 2 TUs if contamination is identified in Phase 1 TUs. For both Phase 1 TUs and Phase 2 TUs, the durable cover (including asphalt, asphalt base course, concrete, gravel, debris, or obstacles) will be removed to expose the target soils.

Phase 1
Phase 1 includes the radiological investigation on a targeted group of TUs. Twenty-four of the 70 former sanitary sewer and storm drain TUs were selected for the Phase 1 investigation. The targeted TUs were selected based on the highest potential for radiological contamination in light of historical documentation of specific potential upstream sources, spills, or other indicators of potential contamination (Naval Sea Systems Command [NAVSEA], 2004), and signs of potential manipulation or falsification from the soil data evaluation (Navy, 2017). The Phase 1 soil investigation will include collection of systematic soil samples from each TU, gamma scan of 100 percent of soil, and collection of biased soil samples, where necessary, based on the gamma scan measurements.

All of the soil (100 percent) will be excavated to the original TU boundaries, as practicable, and gamma scan surveys of the excavated material will be conducted. Excavated soil will be gamma scanned by laying it out on Radiological Screening Yard (RSY) pads. Following excavation to the original TU boundaries, additional excavation of approximately 6 inches of the trench sidewalls and floors will be performed to provide ex situ gamma scanning and sampling of the trench sidewalls and floors. The excavated soil from within each trench and the over-excavation will be tracked separately, and global positioning system (GPS) location-correlated results will be collected.

Systematic and biased samples will be collected from the excavated soil from the TUs and from the soil surrounding the TUs. A minimum of 18 systematic samples will be collected from each excavated soil unit and TU. The soil samples will be analyzed for the applicable ROCs by accredited off-site laboratories. Soil sample locations will be surveyed using GPS. If the investigation results from the gamma scan surveys and results from analysis of systematic and biased soil samples of the over excavated material demonstrate exceedances of the RGs that are not attributed to naturally occurring radioactive material (NORM) or anthropogenic background, the material will be segregated for further evaluation. As directed by the Navy, an in-situ investigation and/or remediation of the trench sidewalls and floor will be performed prior to backfill.

Phase 2
At the remaining 46 TUs, 100 percent radiological surface gamma scan of accessible areas and soil sampling will be conducted. Subsurface soil samples will be collected via borings, with a minimum of 18 borings within the trench and one boring every 50 linear feet along the sidewalls of the trench. The borings will be advanced beyond the floor boundary of the trench or to the point of refusal. Gamma scans of the core will be conducted. Borehole locations will be surveyed using GPS. The soil samples will be analyzed for the applicable ROC analysis by accredited off-site laboratories.

Former Building Site and Existing Building Surface Soil Survey Units
At the 15 SUs associated with former building sites and existing building surface soil, the radiological investigation of surface soil is based on a proposal by the regulatory agencies and includes the following:

- Collection of a minimum of 18 systematic soil samples from each SU
- Gamma scan survey of 100 percent of the soil
- Collection of biased soil samples, where necessary, based on the gamma scan measurements.

For all the surface soil SUs, gamma scan surveys of 100 percent of the surface soil will be conducted. GPS location-correlated results will be collected. Systematic and biased samples will be collected from the surface soil SUs. The soil samples will be analyzed for the applicable ROCs by accredited off-site laboratories. Soil sample locations will be surveyed using GPS.

Building Investigations

Investigations of interior surfaces will be performed for the following building:

- Building 103
- Building 113
- Building 113A
- Building 130
- Building 140
- Building 146

Buildings will be divided into SUs, and the sizes and boundaries of the SUs will be based on the previous plans and reports. The radiological investigation will include collection of a minimum of 18 systematic static alpha-beta measurements from each SU; alpha-beta scanning of surfaces; collection of biased static alpha-beta measurement, where necessary, based on the alpha-beta scan measurements; collection of swipe samples to assess removable contamination levels; and collection of material samples as needed to further characterize areas of interest.

Building 103 includes seven SUs consisting of exposed soil in the crawlspace that will be investigated the same as Phase 1 surface soil SUs.

For Building 140, data will be collected consistent with the *Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping, Hunters Point Shipyard, San Francisco, California* (TtEC, 2011) to confirm the conclusion of no further action.

Data Evaluation and Reporting

Data from the radiological investigation will be evaluated to determine whether the site conditions are compliant with the Parcel B ROD RAO. If the residual ROC concentrations are below the RGs in the Parcel B ROD (Navy, 2009) or are shown to be NORM or anthropogenic background, then the site conditions are compliant with the Parcel B ROD RAO. The following methods will be used to determine whether the residual ROC concentrations comply with the Parcel B ROD RAO:

- Each sample and static measurement result will be compared to the corresponding RG. If all residual ROC concentrations are less than or equal to the corresponding RG, then site conditions comply with the Parcel B ROD RAO.
- Sample and measurement data will be compared to appropriate RBA data and multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include, but is not limited to, population to population comparisons, use of a maximum likelihood estimate (MLE) or background threshold value, graphical comparisons, and comparison with regional background levels. If all residual ROC concentrations are determined to be consistent with NORM or anthropogenic background, then site conditions comply with the Parcel B ROD RAO.

- Each radium-226 (^{226}Ra) sample result exceeding both the corresponding RG and the expected range of background will be compared to concentrations of other radionuclides in the uranium natural decay series. If the concentrations of radionuclides in the uranium natural decay series are consistent with the assumption of secular equilibrium, then the ^{226}Ra concentration is NORM, and site conditions comply with the Parcel B ROD RAO.

If the investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the RGs at agreed upon statistical confidence levels or that residual ROC concentrations are NORM or anthropogenic background, then a remedial action completion report (RACR) will be developed. If the investigation results demonstrate exceedances of the RGs determined from a point-by-point comparison with the RGs at the agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, remediation will be conducted as directed by the Navy, followed by preparation of a RACR. The RACR will describe the results of the investigation, explain any remediation performed, and compare the distribution of data from the sites with applicable reference area data. The RACR will provide a demonstration that site conditions are compliant with the Parcel B ROD RAO through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data.

Organization of the SAP

This SAP which will be included as Appendix A to the Parcel B Removal Site Evaluation Work Plan (WP). Tables are embedded within the worksheets. Figures are presented at the end of the document. The project scoping meeting minutes and responses to comments are included in **Attachment 1**. The field standard operating procedures are provided in **Attachment 2**. DoD Quality Systems Manual Laboratory Limits are provided in **Attachment 3**. Laboratory Standard Operating Procedures are provided in **Attachment 4**. DoD Environmental Laboratory Accreditation Program accreditation letters are included in **Attachment 5**. The technical systems audit checklist is included in **Attachment 6**.

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SAP Worksheets (Table of Contents)

[TOC \o "1-1" \h \z \u]

List of Tables

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List of Appendices

Acronyms and Abbreviations

^{60}Co	cobalt-60
^{90}Sr	strontium-90
^{99}Tc	technetium-99
^{137}Cs	cesium-137
^{210}Bi	bismuth-210
^{210}Pb	lead-210
^{210}Po	polonium-210
^{214}Bi	bismuth-214
^{214}Pb	lead-214
^{218}Po	polonium-218
^{220}Rn	thoron-220
^{222}Rn	radon-222
^{226}Ra	radium-226
^{230}Th	thorium-230
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
^{239}Pu	plutonium-239
°C	degrees Celsius
A&B Labs	A&B Environmental Services, Inc.
amu	atomic mass unit
APP/SSHP	Accident Prevention Plan/Site Safety and Health Plan
Aptim	Aptim Federal Services, LLC
ARS	ARS Aleut Analytical, LLC
BFB	4-Bromofluorobenzene
bgs	below ground surface
BRAC	Base Realignment and Closure
BSC	background subtraction count
BTV	background threshold value
CA	corrective action
CARB	California Air Resources Board
CAS	Chemical Abstracts Service
CCB	continuing calibration blank
CCV	continuing calibration verification
CDPH	California Department of Public Health

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
cm	centimeter(s)
COC	chain of custody; chemical of concern
CSO	Caretaker Site Office
CSM	conceptual site model
CTO	Contract Task Order
CU	counting uncertainty
CVAA	cold vapor atomic absorption
DER	Duplicate Error Ratio
DFTPP	decafluorotriphenylphosphine
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
DL	detection limit
DLC	decision level concentration
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DPT	direct push technology
DQI	data quality indicator
DQO	data quality objective
DRO	diesel range organics
DTSC	California Department of Toxic Substances Control
EBLTL	Environmental Business Line Team Leader
ECD	electron capture detector
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
ESL	Environmental Screening Levels
EWI	Environmental Work Instruction
FCR	Field Change Request
FID	flame ionization detector
FSS	Final Status Survey
ft^2	square foot/feet
FWHM	full width at half maximum
g	gram(s)
GC	gas chromatography
GFPC	gas flow proportional counting
Gilbane	Gilbane Federal
GIS	Geographic Information System
GPS	Global Positioning System
GRO	gasoline range organics

HPAL	Hunters Point ambient level
HPNS	Hunters Point Naval Shipyard
HRA	Historical Radiological Assessment
ICAL	initial calibration
ICALCE	initial calibration – counting efficiency
ICALCT	initial calibration – crosstalk factors
ICALSA	initial calibration – self-absorption curve
ICB	initial calibration blank
ICP	inductively coupled plasma spectrophotometer
ICP/MS	inductively coupled plasma/mass spectrometer
ICS	interference check solution
ICV	initial calibration verification
IECV	initial efficiency calibration verification
IL	investigation level
IR	Installation Restoration
IS	internal standard
IATA	International Air Transport Association
IUPAC	International Union of Pure and Applied Chemistry
keV	kilo-electron volt(s)
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDR	Linear Dynamic Range
LLCCV	low-level calibration check standard
LLRW	low-level radioactive waste
LOD	limit of detection
LOQ	limit of quantitation
LRPM	lead remedial project manager
m	meter(s)
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols Manual
MB	method blank
MDC	minimum detectable concentration
MDL	method detection limit
mg/kg	milligrams per kilogram
mL	milliliter(s)
MLE	maximum likelihood estimate
MO	motor oil
MS	mass spectrometer; matrix spike
MSA	method of standard additions
MSD	matrix spike duplicate

NA	not applicable
NAVFAC LANT	Naval Facilities Engineering Command Atlantic
NAVFAC SW	Naval Facilities Engineering Command Southwest
NAVSEA	Naval Sea Systems Command
Navy	United States Department of the Navy
NCR	Nonconformance Report
NEDD	Navy Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
NORM	naturally occurring radioactive material
NRC	U.S. Nuclear Regulatory Commission
NRDL	Naval Radiological Defense Laboratory
OSHA	Occupational Safety and Health Organization
oz	ounce(s)
PAH	Polycyclic Aromatic Hydrocarbons
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PDS	post-digestion spike
PID	photoionization detector
PLM	polarized light microscopy
PM	Project Manager
PMO-W	Program Management Office - West
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PQL	practical quantitation limit
PRC	PRC Environmental Management, Inc.
PSL	Project Screening Limit
PT	performance testing
PWS	Performance Work Statement
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QCPM	Quality Control Program Manager
QCSR	Quality Control Summary Report
QL	quantitation limit
QSM	Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.3
Ra-226	radium-226
RAO	remedial action objective
RADMAC	Radiological Multiple Award Contract
RASO	Radiological Affairs Support Office
RBA	reference background area

RBC	risk-based criterion
REPM	Radiological Environmental Protection Manager
RER	relative error ratio
RG	remedial goal
ROC	radionuclide of concern
ROD	record of decision
ROICC	Resident Officer in Charge of Construction
RPD	relative percent difference
RPM	Remedial Project Manager
RRT	relative retention time
RSD	relative standard deviation
RSL	regional screening level
RSO	Radiation Safety Officer
RSY	radiological screening yard
RT	retention time
SAP	Sampling and Analysis Plan
SD	storm drain
SDG	sample delivery group
SFDPH	San Francisco Department of Public Health
SFRA	San Francisco Redevelopment Agency
SOP	standard operating procedure
SS	sanitary sewer
SU	survey unit
SUPR	Survey Unit Project Report
SVOC	semivolatile organic compound
SWDIV	U.S. Navy, Southwestern Division
Synectics	Environmental Synectics, Inc.
TBD	to be determined
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
Triple A	Triple-A Machine Shop, Inc.
TtEC	TetraTech EC, Inc.
TU	trench unit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
ug/kg	micrograms per kilogram
USEPA	United States Environmental Protection Agency
VOA	volatile organic analysis/analyte
VOC	volatile organic compound
Water Board	California Regional Water Quality Control Board - San Francisco Bay Region

WP	HPNS Site Evaluation Work Plan
WMP	Waste Management Plan
WS	Worksheet

SAP Worksheet #2 – SAP Identifying Information

Site Name/Number:	**Hunters Point Naval Shipyard**
Operable Unit:	**Not Applicable (N/A)**
Contractor Name:	**Gilbane Federal**
Contract Number:	**N62473-17-D-0005**
Contract Title:	**RADMAC II**
Work Assignment Number (optional):	**CTO N6247318F5364**

1. This SAP was prepared in accordance with the requirements of the Naval Facilities Engineering Command Southwest Division [NAVFAC SW] Work Instructions. Additional guidance taken from the following sources:

- *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5* (USEPA, 2002)
- *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP; USEPA, 2005)
- *Consolidated Quality Systems Manual for Environmental Laboratories, Version 5.3* (DoD/DOE, 2019)
- *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006)

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is a: Project-Specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Scoping/kickoff meeting held by teleconference	6/28/2017

5. List dates and titles of any documents written for previous site work that are relevant to the current investigation.

Title	Author	Date
Final Parcel G Removal Site Evaluation Sampling and Analysis Plan, Former Hunters Point Naval Shipyard, San Francisco, CA	CH2M HILL Inc.	March 2019
Final, Revision 1, Parcel G Removal Site Evaluation Work Plan Addendum, Radiological Investigation, Survey, and Reporting Parcel G, Former Hunters Point Naval Shipyard, San Francisco, CA	Aptim Federal Services, LLC (Aptim)	July 2020a

Title	Author	Date
Field Change Request 001 to the Final Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco, CA	APTIM	August 2020b
Final Hunters Point Shipyard Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939–2003	NAVSEA	August 2004
Final Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping	Tetra Tech EC, Inc.	July 2011
Final Radiological Removal Action Completion Report	Tetra Tech EC, Inc.	2012
Final Remedial Action Completion Report for the Durable Covers Remedy in Parcel B-1	ERRG	2017
Final Remedial Action Completion Report for the Durable Covers Remedy in Parcel B-2	Innovex ERRG	2018

6. List organizational partners (stakeholders) and connection with lead organization:
   - USEPA – Regulatory Stakeholder
   - California Department of Toxic Substances Control (DTSC) – Regulatory Stakeholder
   - California Department of Public Health (CDPH) – Regulatory Stakeholder
   - California Regional Water Quality Control Board-San Francisco Bay Region (Water Board) – Regulatory Stakeholder
   - City of San Francisco – Future Property Owner
   - Surrounding HPNS Community – Public Stakeholder

7. Lead organization: United States Department of the Navy (Navy) - Naval Facilities Engineering Command Southwest (NAVFAC SW), BRAC Program Management Office

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below: No worksheets are excluded from the SAP.

SAP Worksheet #3 – Distribution List

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Paul Stoick	Navy Lead Remedial Project Manager (LRPM)	Navy Base Realignment and Closure (BRAC) Program Management Office-West (PMO-W)	619-524-5755	paul.stoick@navy.mil
Sean-Ryan McCray	Navy Remedial Project Manager (RPM)	Navy BRAC PMO-W	619-524-5322	Sean-Ryan.McCray.ctr@navy.mil
TBD	Navy Quality Assurance Officer (QAO)	NAVFAC LANT (Naval Facilities Engineering Command Atlantic)	TBD	TBD
Matt Liscio	Radiological Environmental Protection Manger	Radiological Affairs Support Office (RASO)	757-887-4692	navsearasoadmin.fct@navy.mil
Hamid Naimi	Navy Resident Officer in Charge of Construction (ROICC)	Navy San Francisco Bay Area	510-387-6129	hamidullah.naimi.ctr@navy.mil
Patricia McFadden	Point of Contact	Navy Caretaker Site Office (CSO)	415-743-4720	[HYPERLINK "mailto:patricia.a.mcfadden@navy"].mil One Avenue of the Palms, Ste.161 San Francisco, CA 94130
Wayne Praskins Judy Huang	Regional Project Manager	USEPA, Region 9	415-972-3181681	[HYPERLINK "mailto:"]govpraskins.wayne@epa.gov

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Nina Bacey	DTSC Lead Regional Project Manager	DTSC	510-540-2480	[HYPERLINK "mailto:juanita.bacey@dtsc"].ca.gov 700 Heinz Avenue, Bldg. F, Ste. 200 Berkeley, 94710-2721

SAP Worksheet #3 – Distribution List (Continued)

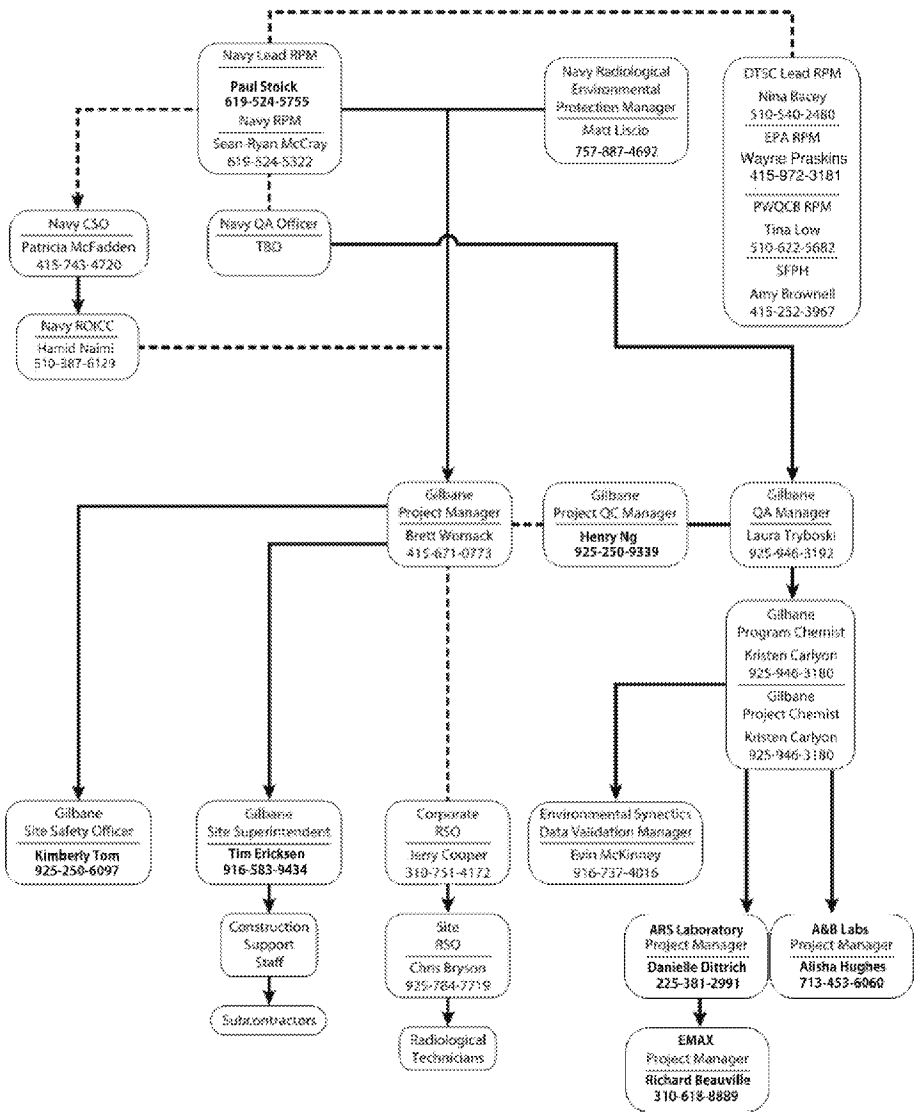
Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Sheetal Singh	Environmental Management Branch	CDPH	916-449-5691	sheetal.singh@cdph.ca.gov
~~Tina LowJeff~~ White	Regional Project Manager	Water Board	510-622-~~23755682~~	Jeff.White@waterboards.ca.gov~~tlow@waterboards.ca.gov~~ 1515 Clay Street, Suite 1400 Oakland, California 94612
Amy Brownell	Project Manager	San Francisco Department of Public Health (SFDPH)	415-252-3967	[HYPERLINK "mailto:robert.wilson@cdph.ca.gov"] 1390 Market Street, Suite 210 San Francisco, CA 94102
Brett Womack	Project Manager (PM)	Gilbane	925-250-8027	bwomack@gillbaneco.com
Laura Tryboski	Quality Control Program Manager (QCPM)	Gilbane	925-946-3192	ltryboski@gillbaneco.com
Jerry Cooper	Corporate Radiation Safety Officer (RSO)/Certified Health Physicist (CHP)	Gilbane	360-751-4172	[HYPERLINK "mailto:jcooper@gilbaneco.com"]
Chris Bryson	Site RSO	Envirachem	925-784-7719	chris.bryson@envirachem.com
Henry Ng	Project Quality Control Manager (PQCM)	Gilbane	925-250-3316	hng@gillbaneco.com
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	925-946-3180	kcarlyon@gillbaneco.com
Danielle Dittrich	Laboratory PM	ARS Aleut Analytical, LLC (ARS)	225-381-2991	ddittrich@aaanalytical.com
Richard Beauvil	Laboratory PM	EMAX Laboratories, Inc. (EMAX)	310-618-8889 X118	rbeauvil@emaxlabs.com
Alisha Hughes	Laboratory PM	A&B Environmental (dba A&B Labs)	713-453-6060 x 127	alishar@ablabs.com
Evin McKinney	Data Validation PM	Environmental Synectics Inc. (Synectics)	916-737-4016	[HYPERLINK "mailto:evin.mckinney@synectics.net"]

SAP Worksheet #4 – Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed[1]	Date SAP Read
Brett Womack	Gilbane/PM	925-250-8027			
Henry Ng	Gilbane/PQCM	925-250-3316			
Chris Bryson	Envirachem/Site RSO	925-784-7719			
Tim Ericksen	Gilbane/Site Superintendent	916-583-9434			
Danielle Dittrich	ARS/Laboratory PM	225-381-2991			
Richard Beauvil	EMAX/Laboratory PM	310-618-8889 x118			
Alisha Hughes	A&B Labs /Laboratory PM	713-453-6060 x 127			
Evin McKinney	Synectics/Data Validator (3rd Party)	916-737-4016			
TBD[2]	Gilbane/Field Crew	Various			
TBD[2]	Gilbane/Field Crew	Various			
TBD[2]	Gilbane/Field Crew	Various			
TBD[2]	Gilbane/Field Crew	Various			

Note:
[1]The sampling personnel will read the appropriate sections of this document before performing activities related to this SAP. The completed sign-off worksheet will be maintained in the Gilbane project file.
[2] Field crew members will be selected at task startup. Persons identified by the PQCM will read the SAP and sign this worksheet as required. Their identities and the number of required personnel have not been determined at the time of publication.

SAP Worksheet #5 – Project Organizational Chart



---------- Lines of Communication
_____ Lines of Authority

SAP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communication with Navy (lead agency)	Navy LRPM Navy RPM NAVSEA RASO, EPM, Health Physicist	Paul Stoick Sean-Ryan McCray Matt Liscio	619-524-5755 619-524-5322 757-887-4962	Primary points of contact (POCs) for Navy; can delegate communication to other internal or external POCs. PM will communicate either verbally or by email with schedule for fieldwork to commence. Navy will provide PM with written instruction to proceed upon completing coordination with Contracting Officer. Navy will notify USEPA, DTSC, CDPH, and SDPH by email or telephone call for significant field changes effecting the scope or implementation of the design.
Communication with USEPA	USEPA RPM	Wayne PraskinsJudy Huang	415-972-31681	Primary POC for USEPA; can delegate communication to other internal or external POCs. Upon notification of field changes, USEPA will review significant field changes. Reports and other project-related information are submitted by the Navy for review and comments by the agency.
Communication with DTSC	DTSC RPM	Nina Bacey	510-540-2480	Primary POC for DTSC; can delegate communication to other internal or external POCs. Upon notification of field changes, DTSC will review significant field changes. Reports and other project-related information are submitted by the Navy for review and comments by the agency.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communication with Water Board	Water Board RPM	~~Tina Low~~Jeff White	510-622-23755682	Primary POC for Water Board; can delegate communication to other internal or external POCs. Upon notification of field changes, Water Board will review significant field changes. Reports and other project-related information are submitted by the Navy for review and comments by the agency.
Communication with SFDPH	SFDPH Project Manager	Amy Brownell	415-252-3967	Primary POC for SFDPH; can delegate communication to other internal or external POCs. Upon notification of field changes, SFDPH will review significant field changes. Reports and other project-related information are submitted by the Navy for review and comments by the agency.
Communication regarding overall project status and implementation, and primary POC with Navy, USEPA, DTSC, Water Board, SFDPH	Gilbane PM	Brett Womack	925-250-8027	Oversees project and will be informed of project status by the field team. If field changes occur, PM will work with the Navy to communicate in-field changes to the regulatory agencies by email. Material and information about the project are forwarded to the Navy by the PM.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Technical communications for project implementation and data interpretation	Gilbane Corporate RSO/CHP Envirachem Site RSO	Jerry Cooper Chris Bryson	360-751-4172 925-784-7719	Contact Corporate RSO/CHP regarding questions/issues encountered in the field, input on data interpretation, as needed. Corporate RSO/CHP will have 24 hours to respond to technical field questions as necessary. Additionally, Corporate RSO/CHP will review data during report preparation.
SAP amendments	Gilbane Program Chemist	Kristen Carlyon Peyton	925-946-3180	Any changes to the SAP are submitted in writing to the Navy QAO, who must approve the changes prior to implementation. The appropriate regulatory agencies will also be notified when SAP amendments are issued.
SAP amendment approvals	Navy QAO	TBD	TBD	Issues final approval of SAP amendments to Program Chemist via signed approval form (electronic signature is acceptable). Concurrence from the Navy LRPM/RPM.
Communication with the Navy QAO	Gilbane Program Chemist	Kristen Carlyon Peyton	925-946-3180	Quality-related materials and information about the project are forwarded to the Navy QAO by the Program Chemist.
Health and Safety	Gilbane Site Safety Health Officer (SSHO)	Kimberly Tom	925-250-6097	Responsible for the adherence of team members to the site safety requirements described in Site Safety and Health Plan (SSHP). Will report health and safety incidents to PM as soon as possible.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Field progress reports	Gilbane Site Superintendent	Tim Ericksen	916-583-9434	Daily field progress reports will be prepared by the Site Superintendent and submitted to the PM by phone or email.
Stop work issues	Gilbane Site Superintendent	Tim Ericksen	916-583-9434	Field Team leader notifies PM about any stopped work that occurs. All field personnel have stop work authority based on the Accident Prevention Plan (APP) and SSHP. The Navy QAO, or representative, has authority to stop work if quality-related compliance issues are identified, or if there is noncompliance with field quality control (QC) protocols, as specified in this SAP.
	Navy QAO	TBD	TBD	
Field or analytical corrective actions (CAs)	Gilbane PQCM Gilbane Program Chemist Gilbane PM	Henry Ng Kristen Carlyon Peyton Brett Womack	925-250-3316 925-946-3180 925-250-8027	Field and analytical issues requiring CA will be determined by the Field Team Leader and/or PM on an as-needed basis; the PM will ensure SAP requirements are met by field staff for the duration of the project. The Site Superintendent will notify the PM via phone of any need for CA within 4 hours. The PM may notify the RPM of any field issues that would negatively affect schedule or the ability to meet project data quality objectives (DQOs). If serious laboratory issues are discovered, the Navy will be notified.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Reporting laboratory data quality issues or analytical corrective actions	ARS PM A&B PM EMAX PM	Danielle Dittrich Alisha Hughes Richard Beauvil	225-381-2991 713-453-6060 310-618-8889 X118	Data quality issues will be reported to the Project Chemist within 2 days. Any corrective actions will be documented and verified by the Project Chemist, who will notify the PQCM, Site RSO (if applicable) and the PM in writing. The PM will notify the BRAC RPM and RASO (if applicable).
Data Tracking from field collection to database upload Release of analytical data	Gilbane Project/Program Chemist	Kristen Carlyon Peyton	925-946-3180	Tracks data from sample collection through database upload daily. No analytical data can be released until validation of the data is completed and has been approved by the Project Chemist. The Project Chemist will review analytical results within 7 days of receipt for release to the project team. The Project/Program Chemist will notify the Navy QAO of any laboratory issues that would prevent the project from meeting project quality objectives or would cause significant delay in project schedule.
Analytical data validation issues	Synectics Data Validation PM	Evin McKinney	916-737-4016	The data validator reviews and qualifies analytical data as necessary. The data along with a validation report are returned to the Project Chemist within 14 calendar days.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Changes in the field	Utility Locater Driller Direct-push Technology Provider Surveyor Investigation-derived waste Transportation and Disposal Provider	TBD	TBD	Documentation of deviations form planned field procedures during project work will be discussed with PM prior to implementation. Deviations will only be made with approval from the PM.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Paul Stoick	LRPM	Navy BRAC PMO-W	Oversees project.
Sean-Ryan McCray	RPM	Navy BRAC PMO-W	Oversees project.
TBD	QAO	NAVFAC LANT	Provides quality assurance oversight for the Navy.
Matt Liscio	EPM, Health Physicist	NAVSEA RASO	Provides radiological technical support for the Navy.
Wayne PreskinsJudy Huang	RPM	USEPA	USEPA POC.
Nina Bacey	RPM	DTSC	DTSC POC.
Sheetal Singh	Environmental Management Branch	CDPH	CDPH POC.
Tina LowJeff White	RPM	Water Board	Water Board POC.
Amy Brownell	PM	SFDPH	SFDPH POC.
Brett Womack	PM	Gilbane	Oversees project activities.
Laura Tryboski	QC Program Manager (QCPM)	Gilbane	Provides quality assurance (QA) oversight for Gilbane.
Jerry Cooper	Corporate RSO/CHP	Gilbane	Provides subject matter support for project approach and execution.
Chris Bryson	Site RSO	Envirachem	Oversees day-to-day radiological operations.
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	Provides Uniform Federal Policy (UFP)-SAP project delivery support, reviews and approves UFP-SAPs, and performs final data evaluation and QA oversight. Performs data evaluation and is the POC with the laboratory and validator for analytical issues.
Tim Ericksen	Site Superintendent	Gilbane	Coordinates all field activities and sampling.

Name	Title/Role	Organizational Affiliation	Responsibilities
TBD	Field Staff	Gilbane/Envirachem	Conduct field activities.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Danielle Dittrich	Laboratory PM	ARS	Manages samples tracking and maintains good communication with Project Chemist.
Richard Beauvil	Laboratory PM	EMAX	Manages samples tracking and maintains good communication with Project Chemist.
Alisha Hughes	Laboratory PM	A & B Labs	Manages samples tracking and maintains good communication with Project Chemist.
Evin McKinney	Data Validator	Synectics	Validate laboratory data from an analytical standpoint prior to data use.

SAP Worksheet #8 – Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider[1,2]	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Radiological	Radiation Safety Awareness Training	Gilbane	Prior to field work	All On-Site Project Personnel	All On-Site Personnel	Project Files
	Radiation Worker Training	Gilbane	Prior to field work	All workers handling radioactive material	Radiation Worker	Project Files
	RCT Training	Gilbane	Prior to field work	All workers performing radiation protection	RCT	Project Files

Notes:

[1]Training in accordance with Radiation Protection Plan provided as Attachment C of the Parcel B Work Plan.

[2] In addition to health and safety-related training, other training may be required as necessary as outlined in the APP/SSHP.

APP/SSHP - Accident Prevention Plan/Site Safety and Health Plan

SAP Worksheet #9 – Project Scoping Session Participants Sheet

Project Name: Radiological Confirmation Sampling and Survey at Parcel B

Site Name: Former Hunters Point Naval Shipyard

Site Location: San Francisco, California

Projected Date(s) of Sampling: Summer 2021 to Summer 2022

Project Manager: Brett Womack, Gilbane

Date of Scoping Session: October 15, 2018

Scoping Session Purpose: Describe Scope of Work

Scoping Session Participants:

Name	Title	Affiliation	Phone	E-mail Address	Project Role
~~Danielle Janda~~Paul Stoick	Lead RPM	Navy BRAC	619-524-6041	paul.stoick@navy.mil~~Danielle.janda@navy.mil~~	Lead RPM ~~(former)~~
Sean-Ryan McCray	RPM	Navy BRAC	619-524-5322	[HYPERLINK "mailto:Sean-Ryan.McCray.ctr@"]navy.mil	RPM
Matt Liscio	Radiological Environmental Protection Manager (REPM)	RASO	757-887-4692	navsearasoadmin.fct@navy.mil	REPM
~~Shirley Ng~~Hamid Naimi	ROICC	Navy	~~510-521-8713~~925-827-7650	hamidullah.naimi.ctr@navy.mil[HYPERLINK "mailto:shirley.ng@navy"]~~.mil~~	ROICC
Doug Delong	CSO	BRAC PMO West	415-743-4713	douglas.delong@navy.mil	CSO
Patricia McFadden	CSO	BRAC PMO West	415-743-4720	patricia.a.mcfadden@navy.mil	CSO
Brett Womack	Project Manager	Gilbane	925-250-8027	[HYPERLINK "mailto:bwomack@gilbaneco.com"]	Project Manager
Arvind Acharya	Program Manager	Gilbane	925-946-3206	[HYPERLINK "mailto:aacharya@gilbaneco.com"]	Program Manager

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Frank VanAlstine	Task Manager	Gilbane	602-792-6815	fvanalstine@gilbaneco.com	Task Manager
Sunshine Ball	Contracts Manager	Gilbane	949-471-2009	sball@gilbaneco.com	Contracts Manager

SAP Worksheet #9 – Project Scoping Session Participants Sheet (Continued)

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Matt Dreesen	Cost & Schedule Specialist	Gilbane	303-256-6174	mdreesen@gilbaneco.com	Cost & Schedule Specialist
Jerry Cooper	Corporate RSO/CHP	Gilbane	360-751-4172	jcooper@gilbaneco.com	Corporate RSO/CHP
Ed Palser	Radiological Program Manager	Gilbane	505-400-4076	epalser@gilbaneco.com	Radiological Program Manager

Comments/Decisions:

A detailed summary of the meeting is included as **Attachment 1**.

Action Items:

No action items were decided upon at the meeting.

Consensus Decisions:

No consensus decisions were reached at the meeting.

SAP Worksheet #10 – Conceptual Site Model

This section provides an updated conceptual site model (CSM) (**Table 10-1**). The CSM summarizes the site description, history, and current status related to former sanitary sewers and storm drains and radiologically impacted buildings identified in the HRA (NAVSEA, 2004). The sanitary sewers and storm drains were once a combined system and had been identified as radiologically impacted because of the possibility that radioactive waste materials were disposed of in sinks and drains, and the potential for the surrounding soil to be impacted by leakage and soil mixing during repairs. A removal action was initiated in 2006 to remove the sanitary sewers and storm drains. The removal action included excavation of overburden soil, removal of pipelines, plugging of open sanitary sewers and storm drains left in place during the removal process, ex situ radiological screening and sampling of the pipeline, and performance of final status surveys of the excavated soil and trench surfaces exposed by excavation. Soil was removed to a minimum of 1 foot below and to the sides of the sanitary sewer and storm drain piping.

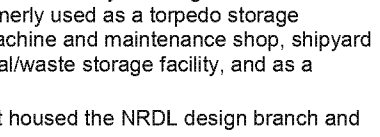
Following the investigation and removal actions, there were allegations that TtEC potentially manipulated and falsely represented data, and some allegations have since been confirmed. In addition, the on-site laboratory used a screening method to analyze radium-226 (^{226}Ra) that may have reported at levels higher than actual radioactivity. TtEC presented CSMs in removal action completion reports that were based on potentially falsified data and screening results for ^{226}Ra reported by the on-site laboratory (results were biased high).

As a result, the Navy will conduct investigations at radiologically impacted soil and buildings in Parcel B that were surveyed by TtEC. The results of additional investigation activities presented in this SAP and the Parcel B WP will be used to update the CSM as needed.

Table 10-1. Conceptual Site Model

Site Name	Former Hunters Point Naval Shipyard (Parcel B)	
Site Location	Located on San Francisco Bay near the southeastern boundary of San Francisco, California. HPNS encompasses approximately 848 acres, including approximately 416 acres on land, at the point of a high, rocky, 2-mile-long peninsula projecting southeastward into San Francisco Bay. Parcel B occupies 59 acres in the northern portion of HPNS (**Figure 1-1**).	
Site Operations and History	• Navy Radiological Defense Laboratory (NRDL) activities associated with analyzing samples from nuclear weapons tests, scientific studies (fallout, plant, animal, materials), and production and use of calibration sources. • The HRA also documents (in Table 5-1) that the Navy had five radioactive licenses with the Atomic Energy Commission for cesium-137 (^{137}Cs), one for a quantity of 3,000 curies and a separate quantity of 20 curies of ^{137}Cs. Two licenses indicate that ^{137}Cs was in sources. In some cases, the Navy made its own sources with ^{137}Cs. • Use of radiography sources. • Use and potential disposal of radiological commodities, including discrete devices removed from ships (e.g., deck markers, radium dials) and welding rods. • Historical radiological material use documented in the HRA (NAVSEA, 2004) lists "impacted sites" – sites with potential for radioactive contamination. • Former surface soil impacted by fallout may be subsurface soil today because of fill activities.	
Historical Site Conditions	Portions of the facility created from fill with some background levels of radionuclides (e.g., NORM and fallout). Dredge spoils from local berths were used as fill for some areas. Trenches were backfilled following removal of sewer lines. Trench backfill is mixed, but documentation of source is available (on-site fill, off-site fill, or mixture). Bay mud or bedrock marks the bottom extent of fill material. The site drainage system was designed in the 1940s to discharge to San Francisco Bay and was separated into sanitary sewers and storm drains in 1958, 1973, and 1976, but never completed.	
Potential Source Areas	**Potential Historical Sources of Radiological Contamination**	• Potential spills and releases from: – Storage of samples from nuclear weapons tests at various NRDL facilities – NRDL waste disposal operations • Incidental disposal of radioluminescent commodities (e.g., dials, deck markers) during maintenance, individually or attached to equipment. • Leaking radiography and could affect buildings listed in HRA Table 6-1. • Small amounts of liquid low-level radioactive waste (LLRW) were authorized for release with dilution to sanitary sewers based on regulations in place at the time.
	Release Areas in Parcel B (within work scope)	**Known Release Areas (from Section 6.4 of the HRA):** • None **Potential Releases Identified after the HRA:** • None

Table 10-1. Conceptual Site Model

	Impacted Buildings in Parcel B (within work scope)	**Impacted Buildings with High Contamination Potential (from Table 8-2 of HRA):** • None **Impacted Buildings with Moderate Contamination Potential (from Table 8-2 of HRA):** • None **Impacted Buildings with Low or No Contamination Potential (from Table 8-2 of HRA):** • Building 103 – Leased building built as a standard WWII wooden barracks; i.e., long, narrow rectangular building topped by a shallow gabled roof with narrow eaves. Building 103 was used as a submarine crew barracks and decontamination center for Operations Crossroads personnel. • Building 113 – Three-story wood-framed shop building with a shallow gabled roof. Its former uses include tug maintenance salvage diver facility, torpedo storage and overhaul, and storage of atomic weapons test samples. • Building 113A – Concrete storage vault enclosed by a corrugated metal-sided shallow gable roof structure. It was formerly used as a torpedo storage building, non-destructive test facility, machine and maintenance shop, shipyard analytical laboratory, radioactive material/waste storage facility, and as a radiographer's vault. • Building 114 – Demolished building that housed the NRDL design branch and technical library. • Building 130 – Wood-framed shop building built in 1944 that includes open sheds on both sides and an almost flat, shallow gabled roof with wooden sliding industrial doors at either end. Building 130 currently is used for environmental hazardous material storage. Formerly it was used as an LLRW storage area, pipe fitter shop, ship repair shop, machine shop, and metal-working shop. • Building 140 – Unoccupied one-story rectangular brick building with a rounded eastern end resembling an apse. Building 140 was used as a dry dock pump house and discharge channel. • Building 142 – Demolished concrete building that was used as an air raid shelter, weapons test high-level sample storage area, and a low background sample counting room. • Building 146 – Wood-framed structure with a shallow gabled roof with windows built in 1945. Its former uses included industrial and phot laboratory, general shops, radioactive waste storage area, and radioluminescent device storage turn-in building. • Building 157 – Demolished corrugated metal, wood-framed structure. Building 157 was used as a shipyard industrial laboratory, non-destructive testing and sound laboratory, metals testing shop, and metal shop. **Buildings Identified after the HRA:** • None
Radionuclides of Concern for Parcel B (from Table 8-2 of HRA)[1]		• ^{226}Ra (Buildings 113A, 114, 130, 140, 142, 146, 157) • ^{137}Cs (Buildings 103, 113, 113A, 114, 130, 140, 142, 146, 157) • Strontium-90 (^{90}Sr; Buildings 103, 113, 114, 140, 142, 146) • Cobalt-60 (^{60}Co; Building 157)[2] • Plutonium-239 (^{239}Pu; Buildings 103, 113, 140, 142)
Potential Migration Pathways		• Releases to soil and air. • Releases to sanitary sewer lines. – Buildings with known releases • Releases to storm drains. – Incomplete separation from sanitary sewer lines • Runoff from surface spills. • Releases from potentially leaking storm drain and sanitary sewer lines to surrounding soil (lines and soil now removed). • Release of sediments from breaks or seams during power washing of drain lines.  Conceptual Cross Section of Drain Lines
Potential Exposure Pathways		• Soil: – External radiation from ROCs – Incidental ingestion and inhalation of soil and dust with ROCs for intrusive activities disturbing soil beneath the durable cover (only construction worker receptor) • Building surfaces: – External radiation from ROCs – Inhalation and incidental ingestion of re-suspended radionuclides

1 The site-specific ROCs for the soil and building investigations are listed in **Table 17-1** and **Table 17-2**.
2 The most recent documented use of Building 157 as an industrial laboratory was 1984 (HRA Table 3-4); therefore, any residual ^{60}Co (half-life =5.26 years) has undergone decay of nearly seven half-lives.

Table 10-1. Conceptual Site Model

Current Status	• HPNS is not an active military installation. In 1991, HPNS was selected for closure pursuant to the terms of the Defense Base Realignment and Closure (BRAC) Act of 1990. For more than 20 years, the Navy leased many HPNS buildings to private tenants and Navy-related entities for industrial and artistic uses. Current leases include art studios and a police department facility. Parcels A, D-2, UC-1, and UC-2 have been transferred to the City and County of San Francisco for non-defense use, and transfer of the remaining areas of HPNS also is planned. • All known sources removed by Navy using standards at the time. – Follow-up investigations resulted in removal of small volumes of soil to meet current RGs • Sanitary sewer and storm drain removal investigation conducted at Parcel B from 2006 to 2010. – More than 4.7 miles of trench lines and 65,000 cubic yards of soil investigated and disposed of or cleared for use as on-site fill – Trench excavations that have been backfilled now contain homogenized soil from on-site fill, off-site fill, or a mixture of both
Uncertainties	• Lower potential for radiological contamination than originally described in historical CSMs based on the following lines of evidence: – Known sources have been removed. – Sanitary sewers and storm drains, and 1 foot of soil surrounding the pipe removed. The sewer lines were removed to within 10 feet of all buildings. Impacted buildings had remaining lines removed during surveys of the buildings. Non-impacted buildings had surveys performed at ends of pipes, and pipes were capped. – Any residual concentrations may be modified by radiological decay (shorter-lived radionuclides, such as ^{137}Cs and ^{90}Sr) or remobilization (including weathering and migration). – Sediment data from inside pipe not indicative of a large quantity disposal or contamination. – Overestimation of ^{226}Ra concentrations in soil by the on-site laboratory using an imprecise measurement method. • Data manipulation or falsification. • Data quality deficiencies. • ^{137}Cs and ^{90}Sr are present at HPNS because of global fallout from nuclear testing or accidents, in addition to being potentially present as a result of Navy activities. Because of backfill activities, ^{137}Cs and ^{90}Sr from fallout and Navy activities are not necessarily only on the surface and may be present in both surface and subsurface soil. • Potential for isolated radiological commodities randomly distributed around the site. • Trenches where scan data exceeded the investigation level (IL) and biased soil samples were not collected.

Notes:
^{60}Co = cobalt-60
^{90}Sr = strontium-90
^{137}Cs = cesium-137
^{239}Pu = plutonium-239
BRAC = Base Realignment and Closure
IL = investigation level
LLRW = low-level radioactive waste
NORM = naturally occurring radioactive material
NRDL = Navy Radiological Defense Laboratory
pCi/g = picocurie(s) per gram

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

Step 1	State the Problem

Data manipulation and falsification were committed by a contractor during past sanitary sewer and storm drain removal actions and current and previous building investigations in Parcel B. The Technical Team evaluated soil and building survey data and found evidence of potential manipulation and falsification. The findings call into question the reliability of soil and building data, and there is uncertainty whether radiological contamination was present or remains in place. Therefore, the property cannot be transferred as planned. Based on the uncertainty and the description of radiological activities in the HRA, there is a potential for residual radioactivity to be present in soil and on building interior surfaces.

Furthermore, HPNS was expanded over time using fill materials with a range of concentrations of NORM. Construction and remediation projects over the past 60 years have disturbed the surface soil, making a determination of background concentrations for anthropogenic radionuclides from fallout difficult. Previous HPNS soil background values did not provide ^{226}Ra concentrations representative of all fill materials found at HPNS and did not include other NORM or fallout radionuclides.

Step 2	Identify the Objective

The primary objectives of the study are as follows:

- To determine whether site conditions in soil and building surfaces are compliant with the Amended Parcel B ROD RAO (Navy, 2009).
- To confirm, or update as necessary, estimates of naturally occurring and man-made background levels for ROCs not attributed to Naval operations at HPNS.
- To determine whether import fill material meet acceptance criteria for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), metals, asbestos, pH, and radionuclides as presented in the **SAP Worksheets #15.5 through #15.14**.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 3	**Identify Information Inputs to the Objective**

The inputs for each component of the study are as follows:

Soil Investigation

- Validated surface soil and subsurface soil analytical data for the applicable ROCs provided by an accredited offsite laboratory. The ROCs for the soil investigation are listed below and are presented on **SAP Worksheet #17**
  - ROCs from the former sanitary sewer and storm drain lines are ^{137}Cs, ^{226}Ra, ^{90}Sr.
  - ROCs from the Buildings 103, 114, 130, 142, and 157 areas are ^{137}Cs, ^{60}Co, ^{226}Ra, ^{90}Sr, ^{239}Pu.
- Gamma Scan survey measurements to identify biased soil sample locations.
- Validated reference background area (RBA) surface and subsurface soil analytical data for the applicable ROCs will be used to confirm, or update as necessary, estimates of naturally occurring and man-made background levels for ROCs not attributed to Naval operations at HPNS.
- Validated data from sampling of import fill material if needed (dependent on source of fill as per guidance provided in the *Information Advisory Clean Import Fill Material* (DTSC, 2001).

Building Investigation

- Alpha-beta static, and alpha-beta scan, and alpha-beta swipe sample data collected by radiological survey instruments on buildings and reference area surfaces.
- Radioactivity concentration data for material or swipe samples provided by an accredited offsite laboratory (if needed).
- Radioactivity concentration data for sediment samples provided by an accredited offsite laboratory (if needed at Building 140).

Step 4	**Define the Boundaries of the Study**

Soil Investigation

- Phase 1 and Phase 2 trench units (TUs) and surface soil survey units (SUs) shown on **Figure 3-1** and presented on **Worksheet #17**.

Building Investigation

- Accessible interior surfaces of Buildings 103, 113, 113A, 130, 140 (consistent with the *Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping* [TtEC, 2011]), and 146 (**Figure 4-1**). The building floor plans (i.e., Class 1 and 2 SUs) are depicted on **Figures 4-2** through **Figure 4-9.**

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 5	Develop the Analytical Approach

The decision rules for this investigation are:

Soil and Building Investigations:

- **If** the building and soil investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the RGs (**Worksheet 15.1 - 15.3 and Worksheet #17**) at agreed upon statistical confidence levels, or that residual ROC concentrations are NORM or anthropogenic background, **then** a RACR will be developed.
- **If** the building and soil investigation results demonstrate exceedances of the RGs based on a point-by-point comparison with the RGs at agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, **then** remediation will be conducted followed by preparation of a RACR. Remediation will be based on the following:
  - **If** one Phase 1 trench unit (TU) (Worksheet #17) does not meet the Amended Parcel B ROD RAO, **then** all Phase 2 TUs will be excavated (**Worksheet #17**).
  - **If** all Phase 1 TUs meet the Amended Parcel B ROD RAO, **then** Phase 2 will be initiated for TUs.
  - **If** any one Phase 2 TU does not meet the Amended Parcel B ROD RAO, **then** all the Phase 2 TUs will be excavated.
  - **If** any soil survey unit (SU) (Worksheet #17) does not meet the Amended Parcel B ROD RAO, **then** the SU will be excavated.
  - If multiple Phase 2 survey units / trench units have contamination, then additional survey units / trench units may need 100% full excavation and treatment in a manner similar to Phase 1.

Equilibrium Status Evaluations:

- **If** the ^{226}Ra result is similar to the results for the other radionuclides in the uranium natural decay series, **then** the ^{226}Ra activity is NORM and complies with the Parcel B ROD RAO, and the equilibrium determination will be documented in the RACR.
- **If** the ^{226}Ra result is significantly greater than the results for the other radionuclides in the uranium natural decay series (see Step 6) and exceeds the RG, **then** the elevated ^{226}Ra level may be attributed to site contamination, and remediation may be required.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 5 | Develop the Analytical Approach (Continued)

Import fill material:

- **If** the required sampling frequency meets the requirements outlined in DTSC guidance (**SAP Attachment 6**), and the results meet the acceptance criteria presented in **Worksheets #15-5** through **#15-14**, **then** the source will be considered suitable for backfill.
- **If** the required sampling frequency does not meet the requirements outlined in the DTSC guidance (SAP Attachment 6), and/or results do not meet the acceptance criteria presented in **Worksheets #15-5** through **#15-14**, **then** the source will not be considered suitable for backfill.

RACR:

- The RACR will describe the results of the investigation, explain remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the Amended Parcel B ROD RAO through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data.

Step 6 | Specify Performance or Acceptance Criteria

The performance criteria for each component of the study are as follows:

- The soil investigation data evaluation process for demonstrating compliance with the Amended Parcel B ROD RAO is presented in Section 5 of the Parcel B Work Plan and depicted on **Figure 3-2**.
  - Compare each ROC **(Worksheet #17)** concentration for every sample to the corresponding RG **(Worksheet #17)**.
    - If all concentrations for all ROCs for all samples are less than or equal to the RGs, then compliance with the Amended Parcel B ROD RAO is achieved.
  - Compare sample data to appropriate RBA data from HPNS as described in Section 5 of the Parcel B Work Plan. Multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include, but is not limited to, population-to-population comparisons, use of a maximum likelihood estimate (MLE) or background threshold value (BTV), graphical comparisons, and comparison with regional background levels.
    - If all residual ROC concentrations are consistent with NORM or anthropogenic background, site conditions comply with the Amended Parcel B ROD RAO.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 6	Specify Performance or Acceptance Criteria (Continued)

- If any ^{226}Ra gamma spectroscopy concentration exceeds the ^{226}Ra RG and the range of expected NORM concentrations, then the soil sample will be analyzed for uranium isotopes (^{238}U, ^{234}U), thorium-230 (^{230}Th), and ^{226}Ra to evaluate equilibrium conditions.
- If the concentrations of radionuclides in the uranium natural decay series are consistent with the assumption of secular equilibrium, then the ^{226}Ra concentration is NORM, and site conditions comply with the Amended Parcel B ROD RAO.

- If any result is greater than the RG and cannot be attributed to NORM or anthropogenic background, then remediation will be performed prior to backfill.

- The building investigation data evaluation process for demonstrating compliance with the Amended Parcel B ROD RAO is presented as follows and depicted on **Figure 4-10:**
  - Compare each net alpha and net beta result to the corresponding RG from **Worksheet #17**:
    - If all results are less than or equal to the RGs, then compliance with the ROD RAO is achieved.
  - Compare survey data to appropriate RBA data from HPNS as described in the Parcel B Work Plan. Multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include, but is not limited to, population-to-population comparisons, use of an MLE or BTV, and graphical comparisons.
    - If survey data are consistent with NORM or anthropogenic background, then site conditions comply with the Amended Parcel B ROD RAO.
    - If any result is greater than the RG and cannot be attributed to NORM or anthropogenic background, remediation will be conducted.

Step 7	Develop Plan for Obtaining Data

Data for each component of the study will be obtained through the following methods:

Soil Investigation:
For the TUs associated with the former sanitary sewers and storm drains, a phased investigation approach was designed based on a proposal by the regulatory agencies to achieve a high level of confidence that the Amended Parcel B ROD RAO has been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 33 percent of the TUs in Parcel B. Soil sampling and scanning at the remaining 67 percent of TUs was proposed as part of Phase 2 to increase confidence that current site conditions comply with the Parcel B ROD ROA. Evaluation of the results of Phase 1 may lead to re-excavation of Phase 2 TUs. For both Phase 1 TUs and Phase 2 TUs, the durable

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 7	Develop Plan for Obtaining Data (Continued)

cover (including asphalt, asphalt base course, concrete, gravel, debris, or obstacles) will be removed to expose the target soils.

- Phase 1 TUs – The radiological investigation will be conducted on a targeted group of 24 of the 70 TUs associated with former sanitary sewers and storm drains in Parcel B (see **Figure 3-1**). Phase 1 TUs will be investigated using gamma scan surveys and soil sampling as described in **Worksheets #14 and #17**.
- Phase 2 TUs – Gamma scan surveys, soil sampling, and scanning of soil cores will be conducted on the remaining 46 TUs associated with former sanitary sewers and storm drains in Parcel B (see **Figure 3-1**). The Phase 2 TUs will be investigated as described in **Worksheets #14 and #17**. Phase 2 will only be performed if no contamination is found during Phase 1. If contamination is found during Phase 1, then all of the Phase 2 TUs will be excavated and investigated following the process described for the Phase 1 TUs.
- Surface Soil SUs – The radiological investigation will be conducted at 15 SUs associated with surface soil at Buildings 103 and former Buildings 114, 142, and 157 in Parcel B (see **Figure 3-1**). The SUs will be investigated as described in **Worksheets #14 and #17**.
- Soil samples collected will be analyzed as described below for the applicable ROCs by accredited offsite laboratories and the results will be evaluated as described in Step 6. The excavated soil from within each trench and over-excavation will be tracked separately, and global positioning software (GPS) location-correlated results will be collected or surveying conducted.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 7	Develop Plan for Obtaining Data (Continued)

- All soil samples at a minimum will be assayed by gamma spectroscopy for ^{137}Cs and ^{226}Ra. Gamma spectroscopy data will be reported by the laboratory after a full 21-day in-growth period. If the laboratory results indicate a concentration of ^{226}Ra above the RG (**Worksheet #15.1**), the sample will be analyzed using alpha spectroscopy for uranium isotopes (^{238}U, ^{235}U, ^{234}U), thorium isotopes (^{232}Th, ^{230}Th, and ^{228}Th), and ^{226}Ra. If the laboratory results indicate concentrations of ^{137}Cs above its RG (Worksheet #15.1), the sample will be analyzed for ^{90}Sr and by alpha spectroscopy for ^{239}Pu.
- Additionally, at least 10 percent of randomly selected samples will receive gas flow proportional counting (GFPC) analysis for ^{90}Sr. If the laboratory results indicate the presence of concentrations of ^{90}Sr at or above the respective RG (**Worksheet #15.3)**, the sample will be analyzed by alpha spectroscopy for ^{239}Pu.

Import Fill Material:

- Import Fill material identified for potential reuse will be sampled prior to use as backfill compliant with *Information Advisory on Clean Import Fill Material* (DTSC, 2001). Sampling is described in more detail in **Worksheets #14** and **#17**.

Building Investigation:

- Building investigations will be conducted on floors, wall surfaces, and ceiling surfaces of Buildings 103, 113, 113A, 130 and 146; and on accessible interior surfaces of Building 140 consistent with the *Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping* (TtEC, 2011). Investigations will be conducted as described in **Worksheets #14** and **#17**.

SAP Worksheet #12 – Measurement Performance Criteria Table

~~Measurement Performance Criteria Table~~ – **Field QC Samples**

Matrix: Soil

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample (Assesses Error for Sampling [S], Analytical [A] or both [S&A])
Field Duplicate	~~All~~None	~~10 percent, one per 10 field samples collected~~None[1]	Precision	Not Applicable	S & A
Equipment Rinse Blanks[2,4]	VOCs, SVOCs, TPH, Pesticides, PCBs, Metals	None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment	Bias/Contamination	< ½ limit of quantitation (LOQ)	S
Matrix Spikes[3,2]	Metals, VOCs, SVOCs, PCBs, Pesticides, TPH	5 percent; one per 20 field samples collected	Precision/Accuracy	Per Worksheet 28	A
Sample Duplicates	Radiochemistry	5 percent; one per 20 field samples collected	Precision	Per Worksheet 28	A
Temperature Blanks[4,3]	Mercury, VOCs, SVOCs, PCBs, Pesticides, TPH	Every cooler shipped to the laboratory	Representativeness	< 6 degrees Celsius (°C)	S
Split Samples[5]	Radiochemistry	All soil samples will be retained for possible CDPH confirmatory analysis until the final RACR for Parcel B is issued.	Not Applicable (NA)	None	S & A

Notes:

[1] Due to the heterogeneous distribution of contaminants typically found in soil/sediment matrix, field duplicates for soil/sediment samples are not considered reliable for determining precision and will not be collected for this project. Sample data are not qualified based on field duplicate precision; matrix spike duplicate or lab replicate data will be used to assess sample precision in soils.

[2,4] Equipment blanks for radiological data are not collected. Prior to chemical decontamination, equipment that comes in contact with samples will be dry wiped. The equipment will be radiologically cleared to confirm lack of radiological contamination in accordance with Appendix D *Radiation Protection Plan* of the WP. See **Worksheet #14**.

[3,2] Per DoD QSM 5.3, Tables B-17 and B-18, matrix spikes are not required for gamma spectrometry (USEPA 901.1) or gas flow proportional counting (USEPA 905.0).

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[43]There are no temperature preservation requirements for metals, radionuclides, or asbestos; therefore, no temperature blanks are required.
[54]May be collected if request by other stakeholders (USEPA or CDPH) and will be evaluated by the stakeholder. Measurement and performance criteria will be outlined in the stakeholder guidance document.

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Remediation Goals	*Final Basewide Radiological Removal Action, Action Memorandum, Hunters Point Shipyard, San Francisco, California, Revision 2006* (April 2006)	Navy, RGs for soil and surfaces	To determine whether site conditions in soil and building surfaces are compliant with the Parcel B ROD RAOs (Navy, 2009), analytical and building data will be compared to the RGs for Parcel B ROCs.	The RGs will be applied as stated in the Parcel B ROD. Analytical results will also be compared to background values.
Trench Unit, Survey Unit Boundaries and Depths	*Multiple plans and reports and the Parcel B Remedial Action Completion Report* (2004-2012)	Tetra Tech EC, Inc., site figures, building layouts, floor plans	Data will be used as the boundaries for TUs and Sus included in the Soil and Building Investigations.	Electronic versions of previous excavations are not available. Alterations of building interiors may have taken place. Therefore, best management practices (BMPs) will be used to locate and mark the boundaries of former TUs and SUs.

SAP Worksheet #14 – Summary of Project Tasks

This worksheet contains procedures for field activities as a supplement to the Parcel B Removal Site Evaluation Work Plan, which contains detailed information on the radiological support activities that will be conducted during the soil sampling and building investigation activities outlined in this SAP. Field SOPs specific to the soil sampling discussed in this SAP are presented in **Worksheet # 21**. All radiological support work will be performed in accordance with the Radiation Protection Plan (RPP), which is included as Appendix C of the Parcel B Removal Site Evaluation Work Plan.

14.1 Premobilization Activities

Before initiating field investigations, several premobilization steps will be completed to ensure that the work can be conducted in a safe and efficient manner. The primary premobilization tasks include procurement of subcontractor services, training of field personnel, permitting and notification, a preconstruction meeting, and building walk-throughs, as described below.

14.1.1 Procurement of Subcontractor Services

A list of the various support services that are anticipated to be required are as follows:

- Analytical laboratory services
- Drilling subcontractor
- Utility location subcontractor
- Vegetation clearance subcontractor
- Transport (trucking) subcontractor
- Concrete coring subcontractor
- Data validation subcontractor

14.1.2 Permitting and Notification

Before initiation of field activities for the radiological investigation, Gilbane will notify the Navy RPM, ROICC, RASO, CSO, and HPNS security as to the nature of the anticipated work. Any required permits to conduct the field work will be obtained before mobilization.

Gilbane will notify the CDPH at least 14 days before initiation of activities involving the Radioactive Material License.

14.1.3 Pre-Construction Meeting

A pre-construction meeting will be held before mobilization of equipment and personnel. The purpose of the meeting will be to discuss project-specific topics, roles, and responsibilities of project personnel, project schedule, health and safety concerns, and other topics that require discussions before field mobilization. Representatives of the following will attend the pre-construction meeting:

- Navy (RPM, RASO, ROICC, and others as applicable)
- Gilbane (PM, Site Superintendent, PQCM, RSO, and SSHO)
- Subcontractors as appropriate

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

14.1.4 Building Walk-throughs

Prior to the start of building survey activities, a walk-through of Parcel B buildings will be completed to accomplish the following:

- Establish building access points and assess security requirements
- Assess survey support needs such as power, lighting, ladders, or scaffolding
- Verify the types of material in each SU
- Identify safety concerns and inaccessible or difficult-to-survey areas
- Identify radiological protection and control requirements
- Identify materials requiring removal or disposal, and areas requiring cleaning
- Assess methods for marking survey scan lanes and static measurement locations

Impacted areas that are deemed unsafe for access or surveying, will be posted, secured, and noted in reports.

14.2 Mobilization Activities

CSO will be notified regarding the planned schedule for mobilization and site investigation activities. Upon receipt of the appropriate records and authorizations, field personnel, temporary facilities, and required construction materials will be mobilized to the site.

The applicable activity hazard analysis forms will be reviewed prior to starting work. The temporary facilities will include restrooms, hand-washing stations, and one or more secure storage (Conex) boxes for short- and long-term storage of materials, if needed.

The mobilization activities are summarized below and are described in detail in the Parcel B Work Plan.

Soil Investigation

The mobilization activities for the soil investigation will include the following:

- Locating and confirming soil TU and SU boundaries
- Establishing a radiologically controlled area
- Implementation of stormwater, sediment, and erosion control measures
- Implementation of dust control methods and air monitoring
- Underground Service Alert will be contacted at least 72 hours before initiating intrusive activities
- Removal and survey of the durable cover of the Phase 1 TUus and Phase 2 TUs
- Movement of equipment and materials to the site. All equipment mobilized to the site will undergo baseline radioactivity surveys in accordance with the Parcel B

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

- Work Plan. Surveys will include contiguous static measurements and swipe samples. Equipment that fails baseline surveying will be removed from the site.

Building Investigation

The mobilization activities for the building investigation will include the following:

- Removal of loose, residual debris to prepare the buildings for cleaning
- Implementation of dust control methods and air monitoring, if warranted as described in the Dust Control Plan (Appendix E to the Work Plan)
- Cleaning of floors, walls, and other surfaces
- Evaluation and disposal of waste generated from cleaning activities
- Movement of equipment and materials to the site. All equipment mobilized to radiologically controlled areas will undergo baseline radioactivity surveys in accordance with the Parcel B Work Plan. Surveys will include direct scans, static measurements, and swipe samples. Equipment that fails baseline surveying will be removed from the site

14.3 Investigation Activities

Once site preparation activities are completed, investigation activities will commence. The following sections describe the field activities specific to each component of the investigation. The survey design for each component is described in detail in the Parcel B Work Plan and summarized in **Worksheet #17**.

Soil Investigation

There are two types of Parcel B soil investigations, including surveys of the following:

- Surface and subsurface soil associated with former sanitary sewer and storm drain lines (TUs)
- Surface soil areas associated with soil from building sites (SUs)

A two-phased approach is planned for the investigation of surface and subsurface TU soil associated with former sanitary and storm drain lines. For surface soil areas associated with soil from building sites, radiological investigation will be conducted at 157 SUs in Parcel B (**Worksheet #17**). The size and boundary of the TUs and SUs will be based on the previous plans and reports. Locating and marking the boundaries of the former TUs and SUs will be accomplished by using BMPs to identify boundaries and depths of the former TUs and SUs based on the previous TtEC reports (e.g., survey reports, drawings, and sketches), field observations (such as GPS locations from geo-referencing, borings, and visual inspection), and durable cover as-built records (**Worksheet #13**). Once the boundaries are located, the areas will be marked with paint or pin flags.

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

Phase 1 Trench Unit

Each Phase 1 TU (**Worksheet #17**) will be excavated to the original excavation limits and evaluated in approximately 152-cubic-meter (~200-cubic-yard) excavated soil units (ESUs). Once the excavation to the original excavation limits has been complete, over-excavation of at least an additional 6 inches outside the estimated previous boundaries of the sidewalls and bottom will be initiated. This exhumed over-excavated material will be maintained separately from the ESUs and will represent the trench sidewalls and floor (sidewall floor unit or SFU).

The excavated material (ESUs and SFUs) will undergo radiological assay following the Radiological Screening Yard (RSY) pad process. Excavated TU materials will be transported to the RSY pad by dump truck or other conventional means. Excavated soil entering an RSY must be accompanied by a truck ticket (paper or digital), to facilitate transfer of the material for radiological processing along a designated truck route. This ticket will provide the RSY staff with the following information:

- Location of excavation, including former TU name
- From which TU sidewall or floor surface material was excavated (if applicable)
- Load number
- Estimated volume of soil
- Date and time of excavation

The RSY personnel will direct the driver to the appropriate RSY pad for soil placement. The truck ticket will be amended with the assigned unique RSY pad number for tracking purposes. Placement of soil on an RSY pad will continue until the soil placed on the RSY pad reaches capacity as identified by the RSY manager (or designee) and is ready for processing.

One hundred percent of the Phase 1 ESU and SFU soils will undergo scan surveys using real-time gamma spectroscopy equipment in the soil sorting process or the RSY pad process. Following completion of investigation activities, the ESU and SFU material will either be returned to the same trench that the material originated from or will be segregated for further investigation.

The RSY pad process is summarized in the following section. The process, including associated scanning instrumentation, is described in further detail in the Parcel B Work Plan. A summary of the sampling design and rationale associated with this process is included in **Worksheet #17**.

Radiological Screening Yard Pad

Excavated TU material will be assayed using the RSY pad process. Excavated TU materials will be transported to the RSY pad by dump truck or other conventional means and spread to a maximum depth of 69 inches thick. Processing activities in the RSY pads include gamma scan surveys, systematic and biased soil sampling and analyses,

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

follow-up investigation activities (as necessary), radiologically clearing the materials for reuse or disposal, and transport of the materials off the RSY pads.

If gamma scan surveys indicate areas of potentially elevated activities as identified in the Parcel B Work Plan, additional investigation will be initiated. At a minimum, Gilbane will further evaluate the gamma scan data and collect biased soil samples. Material with potentially elevated concentrations will remain segregated until completion of the investigation activities. If SFU soil sampling indicates areas of potentially elevated activity above the RGs, and it is confirmed that the soil contains contamination, an in situ investigation of the open trench will be performed at the excavation location of the soil. The in situ investigation will include the performance of a gamma scan over the trench surface requiring investigation and additional biased and systematic sampling as described in the Parcel B Work Plan.

Soil processed by the RSY process and subsequently staged for offsite disposition or onsite reuse will be staged pending evaluation of offsite analytical results and Navy approval for disposition or reuse. If elevated sample results are identified by offsite analysis, the contractor shall notify the Navy and continue with the RSY pad process as described in the Parcel B Work Plan. SFU sampling locations with concentrations that exceed RGs or background, whichever is higher, will be remediated by additional soil excavation. Following completion of scan surveys, sampling, and any potential investigation activities, the excavated material will be returned to the same trench that the material originated from.

Phase 2 Trench Unit
Each Phase 2 TU (**Worksheet #17**) will be investigated using a combination of gamma surface scan, soil core scan surveys, and subsurface soil sample collection. Subsurface soil samples will be collected as described in **Worksheet #21** and **Attachment 2**.

The systematic boring locations will be cored down to approximately 6 inches below the depth of previous excavation within each TU boundary. Sanitary sewer and storm drain lines were sometimes installed on bedrock. In these situations, sampling of bedrock will not be performed. If refusal is encountered within 6 inches of the expected depth of the trench, the soil sample will be collected from the deepest section of the core. If refusal is encountered more than 6 inches above the expected depth of the trench, the sample location will be moved to avoid the subsurface obstruction.

To acquire three samples from each boring, one surface and one floor sample will be collected from each sample core. The sample cores will be scanned for gamma radiation along the entire length of each core, and the scan data will be evaluated to determine whether collection of a biased sample is required as described in the Parcel B Work Plan. If evaluation of scan data does not identify the need for collection of a biased sample, a biased sample will be collected from the core segment with the

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

highest gamma scan reading that was not already sampled, for a total of at least three samples from each core.

Additionally, systematic samples will be collected from sidewall locations every 50 linear feet, representative of each of the trench sidewalls. The boring locations will be located within 1 meter of the previous sidewall excavation limits and will extend to the maximum previous excavation depth. In the same action described in the previous paragraph, core sections will then be retrieved, scanned, and sampled such that at least three samples will be collected from each of the six boring locations.

If GPS reception is available, soil sample locations will be position-correlated with GPS data and recorded. If GPS reception is not available, a reference coordinate system will be established to document gamma scan measurement results and soil sample locations. The reference coordinate system will consist of a grid of intersecting lines referenced to a fixed site location or benchmark. If practical, the GPS coordinates of the fixed location or benchmark will be recorded.

Remediation of soil with analytical results above the RGs or background, whichever is higher, will be performed by excavation of the identified location of the elevated activity or the by excavation of the complete TU for further processing using the RSY pad process. Following excavation, a minimum of five bounding confirmation samples will be collected at the lateral and vertical extents to confirm the removal of contaminated soil. If a Phase 2 TU is excavated in its entirety, it will be investigated following the process described for a Phase 1 TU. Material with potentially elevated concentrations will remain segregated until completion of the investigation activities.

Scanning instrumentation used during the investigation of the Phase 2 TUs are described in further detail in the Parcel B Work Plan. A summary of the sampling design and rationale is included in **Worksheet #17**.

Surface Soil Survey Unit Investigation
Surface soil SUs will be characterized in a similar fashion as the RSY process, using combination of gamma scan surveys and systematic and biased surface soil sampling. Surface soil samples will be collected in accordance with Gilbane SOP PR-TC-02.02.01.01 (**Worksheet #21** and **Attachment 2**).

Gamma scan surveys will be performed as described in the Parcel B Work Plan. If GPS reception is available, gamma scan surveys will be position-correlated with GPS data. If GPS reception is not available, a reference coordinate system will be established to document
gamma scan measurement locations. The reference coordinate system will consist of a grid of intersecting lines referenced to a fixed site location or benchmark. If practical, the GPS coordinates of the fixed location or benchmark will be recorded.

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

Gamma scanning data sets will be transferred from the data logger onto a computer to create spreadsheets, and if feasible, gamma scan survey results will be mapped. Data obtained during the surface gamma scan surveys will be evaluated to identify areas of potentially elevated activity and locations of biased samples as described in the Parcel B Work Plan.

Following the completion of the gamma scan surveys, a minimum of 18 systematic samples will be collected from each soil SU. A summary of the sampling design and rationale is included in **Worksheet #17**.

Building Investigation and Remediation
Building 140 and the Building 404 (selected as the primary RBA in the investigation of Building 140) will be divided into SUs, and the size and boundary of the SUs will be based on the *Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping* (TtEC, 2011), as modified by Gilbane's technical proposal accepted by the Navy, dated August 22, 2018, with the ultimate requirement to demonstrate compliance with the Parcel B ROD RAO (**Worksheet #17**).

Radiological investigations at these SUs will be conducted to include the following:

- Alpha-beta contiguous ~~static~~ scan measurements of surfaces and a preliminary data review
- Collection of systematic alpha-beta static and swipe measurements and preliminary data review. A minimum of 18 static alpha-beta static measurements will be taken in each SU
- Collection of biased alpha-beta static and swipe measurements where necessary based on the alpha-beta scan measurements, and preliminary data review
- Delineation and remediation of residual contamination, if present
- Collection of building material samples, if necessary
- Collection of water and/or sediment samples, if present in sufficient quantity in flooded pump pit and discharge piping areas

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The building investigation activities, including scanning instrumentation, are presented in detail in the Parcel B Work Plan. A summary of the survey design and rationale for the building investigation is included **Worksheet #17**.

Assessment of Residual Materials and Equipment
Building 140 contains residual materials and equipment from past operations, such as installed electrical cabinets and discharge piping, that will undergo radioactivity surveys in accordance with Appendix C of the Parcel B Work Plan. These surveys may include a combination of surface scans, static measurements, swipe samples, and material

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

samples. Where possible, sampling or survey points accessed during previous surveys will be used as a starting point. Surveys of impacted building material and equipment will be incorporated into the building SU. After data evaluation, disposition decisions, and subsequent investigation of the surfaces below the materials and equipment, will be coordinated with the Navy.

Remediation of Contaminated Building Surfaces
Following the identification and characterization of contaminated building surfaces, remediation of building surfaces may be performed to ensure that residual radioactivity meets the Parcel B ROD RAO. Specific remediation or decontamination techniques will depend on contaminant, type of surface, and other site-specific factors. Types of decontamination that may be performed include concrete scarifying or scabbling, application of strippable surface coatings, and bulk removal of building components. Remediation will be conducted in building areas with activity that exceed RGs or background, whichever is higher. Confirmation measurements will be collected where remediation is performed to verify that contamination has been removed.

Import Backfill Material Sampling
Samples will be collected at the frequency defined in the *Information Advisory, Clean Imported Fill Material* (DTSC, 2001) from representative locations throughout the borrow source area or borrow source stockpile.

- Only soil and fine materials will be sampled.
- Sample locations will be defined using a sampling grid (i.e., sample quadrants).
- Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
- A disposable scoop, or equivalent will be used to access each location and collect the sample. Soil will be placed into sample containers that will be filled completely. Sample containers are listed in **Worksheet #19**. For VOCs or TPH-p analysis, TerraCore™ samples will be collected as described in SOP PR-TC-02.02.01.05 (**Attachment 2**).

14.4 Decontamination and Release of Equipment and Tools
Disposable equipment will be used whenever applicable and will be disposed of immediately after use. Decontamination of mobilized materials and equipment will be conducted at completion of fieldwork. Prior to decontamination, non-disposable sampling equipment will be wiped down and radiologically surveyed using a hand-held alpha/beta survey meter. If radioactivity exceeding the release limits shown below in **Table 14-1** is detected, the sampling equipment will be wiped down again and resurveyed.

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

Table 14-1 Radiological Release Limits		
Type of Radiation	**Removable (disintegrations per minute [dpm]/100cm^2**	**Total (dpm/100cm^2)**
Alpha	20	100
Beta	1,000	5,000

Note: To eliminate the need for isotopic identification, alpha radioactivity is assumed to be ^{226}Ra, ^{60}Co, ^{137}Cs, or ^{239}Pu, and beta radioactivity is assumed to be ^{90}Sr.

Once radioactivity is below release limits, non-disposable sampling equipment that comes into contact with samples will be decontaminated to prevent the introduction of extraneous material into samples, and to prevent cross-contamination between samples. Numerous decontamination methods are available for use. If practical, manual decontamination methods should be used. Abrasive methods may be necessary if areas of fixed contamination are identified. Chemical decontamination can also be accomplished by using detergents for nonporous surfaces with contamination present. Chemicals selected used for decontamination will be selected to minimize the creation of mixed waste.

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14.5 Management of Investigation Derived Waste

Waste characterization and disposal will be performed as detailed in the Waste Management Plan (WMP; Section 7 of the Work Plan) in accordance with all Federal, State, and local regulations. In addition, all requirements from the disposal facility(s) will be complied with as well. Waste sampling procedures are in accordance with Gilbane SOP PR-TC-02.02.07.01 (**Attachment 2**).

14.6 Site Restoration and Demobilization

The open excavations will be backfilled with the excavated soil upon concurrence from the Navy. The excavated material will be returned to the same trench from which the material originated. If additional backfill is required to complete backfill requirements, DTSC's guidance, *Information Advisory Clean Imported Fill Material* (DTSC, 2001), must be used in conjunction with **Worksheets 15.4 through 15.13**. If the trench excavations are waterlogged, crushed rock or gravel will be placed as bridging material. With Navy concurrence, radiologically cleared recycled fill materials may be used for backfill. The backfill will be compacted to 90 percent relative density by test method ASTM International D1557. Once the excavated areas have been backfilled, the durable cover will be repaired "in kind" to match pre-excavation action conditions.

Deconstruction of RSY Pads

Following completion of radiological screening and with Navy approval, the RSY pads will be deconstructed. Before deconstruction, the RSY pads will be radiologically screened and released. The area will be down-posted for the deconstruction activities. The RSY pad material will be consolidated onsite for offsite disposal at an approved

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

disposal facility. If the RSY pad buffer material cannot be reused onsite, it will be disposed offsite at an approved disposal facility as indicated in the Parcel B Work Plan. Following deconstruction, the area will be restored to pre-removal action conditions.

Demobilization
Demobilization will consist of surveying, decontaminating, and removing equipment and materials used during the investigations, cleaning the project site, inspecting the site, and removing temporary facilities. Demobilization activities will also involve collection and disposal of contaminated materials, including disposable equipment for which decontamination is inappropriate.

14.7 Data Management, Verification, and Validation

Data Management
Radiological survey and environmental data will be maintained in accordance with Appendix C of the Parcel B Work Plan and **Worksheet #29**. Analytical data will be uploaded into the Navy's centralized database (Naval Installation Restoration Information Solution) and will be included in final reports.

Data Verification
The PQCM will have knowledge of radiological QA/QC and will be present in the field for the duration of soil confirmation sampling activities. It will be the PQCM's responsibility to ensure that the QC measures in the project plans are performed, to maintain all QA/QC records for review, and to provide copies in the final report.

Gilbane will conduct weekly QC meetings to keep Navy personnel informed of field progress. Gilbane will prepare all meeting materials, including agenda, figures, data, and look-ahead calendar, and provide copies to all participants 24 hours in advance of the meeting. Meeting minutes will be provided to the Navy within 48 hours of the meeting.

Additionally, the Navy has contracted an independent, third-party contractor to oversee and monitor all field activities and ensure that the activities are in compliance with the Parcel B Work Plan and this SAP.

Additional details regarding data verification are presented in **Worksheets #35-36** and **Worksheet #37**.

Data Validation
Analytical data validation will be conducted by an independent third-party data validation subcontractor in accordance with **Worksheets #34-#36** and consistent with Navy Environmental Work Instruction No. 1, *Data Validation Guidelines for Chemical Analysis of Environmental Samples* (NAVFAC SW, 2001), *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP) (USEPA et al., 2004), the *General Data Validation Guidelines* (DoD, 2019b) and any applicable associated published modules. The data validation findings are summarized in a data validation report. The report

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

content will include an introduction that includes validation guidance used, a summary of the QC elements reviewed, a description of deficiencies, and a summary of the data qualification. The validation qualifiers will be entered electronically by the validator to the EDDs loaded by the laboratory into the Gilbane project database.

14.8 Data Evaluation and Reporting

Soil and Building Investigation

Data from the radiological investigation will be evaluated to determine whether the site conditions are compliant with the Parcel B ROD RAO. The details pertaining to the data evaluation process are summarized below and presented in detail in the Parcel B Work Plan.

Figures 3-2 and **4-3** present an overview of how decisions for soil and building data, respectively, are combined to draw a conclusion on compliance with the Parcel B ROD RAO. Each sample and static measurement result will be compared to the corresponding RG. If the residual ROC concentrations are below the Parcel B ROD RGs or are shown to be NORM or anthropogenic background, then the site conditions are compliant with the Parcel B ROD RAO.

Radiological surveys will include scan measurements of accessible surfaces combined with collection and analysis of swipe samples on building interior surfaces. Scan measurements are used to identify potential areas of elevated radioactivity for investigation using biased samples and static measurements and are not used to directly demonstrate compliance with the Parcel B ROD RAO. Sample and static measurement results at systematic, random, and biased locations are used to evaluate compliance with the Parcel B ROD RAO. A separate compliance decision will be made for each ROC for each sample and static measurement.

If the investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the RGs at agreed upon statistical confidence levels, or that residual ROC concentrations are NORM or anthropogenic background, then a RACR will be developed. If the investigation results demonstrate exceedances of the RGs determined from a point-by-point comparison with the RGs at agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, remediation will be conducted.

Results of radiological investigations for buildings and TUs/SUs complying with the Parcel B ROD RAO will be documented in a RACR, and the buildings and TUs/SUs will be recommended for unrestricted radiological release. The RACR will describe the results of the investigation, include an air monitoring report to evaluate dust and radiological data collected, provide visualizations of spatially correlated data, describe any remediation performed, compare the distribution of data from sites with applicable reference area data, and provide a demonstration that site conditions are compliant with

SAP Worksheet #14 -- Summary of Project Tasks (Continued)

the Parcel B ROD RAO through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data. The final status survey results[3] including a comparison to background and discussion of remedial activities performed as part of the investigation, will be included as an attachment to the RACR.

The reports generated from work outlined in this SAP will be submitted as preliminary draft, draft, draft final, and final versions. The Navy will be provided with each version for review and comment, and documents will be reviewed and approved by the Navy prior to submittal to regulatory agencies. Response to comment (RTC) matrices will be prepared for each comment set received. The RTCs will be used at each review step to facilitate concurrence of responses.

[3] Reported radiological results will, at a minimum, include count times, results, counting uncertainty, and total propagated uncertainty.

SAP Worksheet #15.1 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Radiological (gamma spectroscopy) - USEPA Method 901.1M

Analyte	CAS Number	Project Action Limit[1] (pCi/g)	Project Action Limit Reference	Project Quantitation Limit Goal[2] (pCi/g)	Laboratory-specific Limits[3,4,5,6,8]	
					MDC (pCi/g)	MDL (pCi/g)
Cesium-137	10045-97-3	0.113	Parcel B ROD RG	0.08	0.07	NA
Radium-226[7]	13982-63-3	1.0 pCi/g above background	Parcel B ROD RG	0.7	0.4	NA
Bismuth-214	14913-49-6	None	None	0.7	0.4	NA
Lead-214	15067-28-4	None	None	0.2	0.2	NA
Potassium-40	13966-00-2	None	None	1.2	1.2	NA
Actinium-228	14331-83-0	None	None	0.5	0.5	NA
Bismuth-212	14913-49-6	None	None	0.7	0.7	NA
Lead-212	15092-94-1	None	None	0.2	0.2	NA
Americium-241	14596-10-2	None	None	0.2	0.2	NA
Cobalt-60	10198-40-0	0.0361	Parcel B ROD RG	0.1	0.1	NA
Europium-152	14683-23-9	None	None	0.4	0.4	NA
Europium-154	15585-10-1	None	None	0.2	0.2	NA
Protactinium-234	15100-28-4	None	None	0.2	0.2	NA
Lead-210	14255-04-0	None	None	2.0	2.0	NA
Thorium-232	7440-29-1	None	None	0.5	0.5	NA
Thorium-234	15065-10-8	None	None	2.0	2.0	NA
Thallium-208	14913-50-9	None	None	0.1	0.1	NA

SAP Worksheet #15.1 – Reference Limits and Evaluation Table (Continued)

Notes:

1These values are based on those provided in the *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009). The project action limit is the RG value provided in the Parcel B ROD or the background concentration, whichever is higher.

[2] Project Quantita5tion Limit (QL) goals for individual samples are equal to the MDC and will be a maximum of 90 percent of the RG.

[3]Results for non-aqueous samples are reported on a dry-weight basis.

[4]The MDC is an estimate of the smallest true activity (or activity concentration) of an analyte in a sample that results in a 95 percent probability of detection, given a detection criterion that includes a 5 percent probability of false detection in an analyte-free sample. MDCs may vary from sample to sample depending on the composition of the sample matrix. Any changes to these limits that affect the project SAP objectives must be approved by the Navy RPM and QAO in writing in advance of sample testing.

[5]Count time will be based on meeting the MDC for ^{60}Co. An MDC of 0.1 pCi/g represents a count time of 6 hours.

[6]The isotope list above will be used for samples that have undergone an in-growth period; radium-226 will be reported based on the 609 keV bismuth-214 gamma energy peak.

[7] Remediation goal is 1 pCi/g above background per agreement with USEPA (established in *Final Basewide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California*, dated April 21, 2006), and is consistent with the radiological-related remedies selected in the ROD for Parcel B. The ^{226}Ra background will be established as described in the Parcel B Work Plan.

[8] The SOPs reflect standard method MDCs that are the default values if a project does not specify a site-specific detection limit. The MDCs listed in this worksheet can be achieved with larger aliquots or longer count times within the constraints of the method in order to achieve project objectives. MDC is the minimum detectable concentration, which is an equivalent calculation to the minimum detectable activity (MDA).

keV = kilo-electron volts
MDC = minimum detectable concentration
MDL = method detection limit
NA = not applicable
pCi/g = picocuries per gram
RG = remediation goal
ROD = Record of Decision

SAP Worksheet #15.2 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Radiological (gas flow proportional counting) - USEPA Method 905.0M

Analyte	CAS Number	Project Action Limit[2] Goal (pCi/g)	Project Action Limit Goal Reference	Project Quantitation Limit Goal[3] (pCi/g)	Laboratory-specific Limits[3,4,5,6]	
					MDC (pCi/g)	MDL (pCi/g)
Strontium-90	10098-97-2	0.331	Parcel B ROD RG	0.25	0.25	NA
Total Strontium[1]	7440-24-6	0.331	NA	0.25	0.25	NA

Notes:

[1] Total strontium analysis will be performed first by the laboratory. If the total strontium result is less than the Project Quantitation Limit Goal no additional analysis will be required. However, if the total strontium result is above the Project Quantitation Limit Goal, then ^{90}Sr-specific analysis may be performed to establish a specific ^{90}Sr concentration.

[2] These values are based on those provided in the *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009). The project action limit is the RG value provided in the Parcel B ROD or the background concentration, whichever is higher.

[3] Project QL goals for individual samples are equal to the MDC and will be a maximum of 90 percent of the RG.

[4] Results for non-aqueous samples are reported on a dry-weight basis.

[5] The MDC is an estimate of the smallest true activity (or activity concentration) of an analyte in a sample that ensures a 95 percent probability of detection, give a detection criterion that includes a 5 percent probability of detection in an analyte-free sample. MDCs may vary from sample to sample depending on the composition of the sample matrix. Any changes to these limits that affect the project SAP objectives must be approved by the Navy RPM and QAO in writing in advance of sample testing.

[6] The SOPs reflect standard method MDCs that are the default values if a project does not specify a site-specific detection limit. The MDC listed in this worksheet can be achieved with larger aliquots or longer count times within the constraints of the method in order to achieve project objectives. MDC is the minimum detectable concentration, which is an equivalent calculation to the MDA.

SAP Worksheet #15.3 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Radiological (alpha spectroscopy) – USDOE Method HASL 300 Pu-02 RC Mod and HASL 300 SE-03 Mod

Analyte	CAS Number	Project Action Limit Goal[1] (pCi/g)	Project Action Limit Goal Reference	Project Quantitation Limit Goal[2] (pCi/g)	Laboratory-specific Limits[3,4,5]	
					MDC (pCi/g)	MDL (pCi/g)
Radium-226[6]	13982-63-3	1.0 pCi/g above background	Parcel B ROD RG	0.3	0.3	NA
Plutonium-239/240	7440-07-5	2.59	Parcel B ROD RG	0.5	0.5	NA
Uranium-234	13966-29-5	None	None	0.5	0.5	NA
Uranium-235/236	15117-96-1	None	None	0.5	0.5	NA
Uranium-238	7440-61-1	None	None	0.6	0.6	NA
Thorium-228	14274-82-9	None	None	0.5	0.5	NA
Thorium-230	14269-63-7	None	None	0.5	0.5	NA
Thorium-232	7440-29-1	None	None	0.5	0.5	NA

Notes:

1These values are based on those provided in the *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009). The project action limit is the RG value provided in the Parcel B ROD or the background concentration, whichever is higher.
[2]Project QL goals for individual samples are equal to the MDC and will be a maximum of 90 percent of the RG.
[3] Results for non-aqueous samples are reported on a dry-weight basis.
[4]The MDC is an estimate of the smallest true activity (or activity concentration) of an analyte in a sample that ensures a 95 percent probability of detection, give a detection criterion that includes a 5 percent probability of detection in an analyte-free sample. MDCs may vary from sample to sample depending on the composition of the sample matrix. Any changes to these limits that affect the project SAP objectives must be approved by the Navy RPM and QAO in writing in advance of sample testing.
[5]The SOPs reflect standard method MDCs that are the default values if a project does not specify a site-specific detection limit. The MDC listed in this worksheet can be achieved with larger aliquots or longer count times within the constraints of the method in order to achieve project objectives. MDC is the minimum detectable concentration, which is an equivalent calculation to the MDA.
[6]Where possible, isotopic analysis for ^{226}Ra will be performed using the same dissolution/digestion as ^{238}U to ensure comparability of results. If analysis of ^{226}Ra is not possible due to interferences, radon emanation (**Worksheet #15.4**) will be performed. All detected radium isotopes will be reported.

SAP Worksheet #15.4 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Radiological (radon emanation) – USEPA Method 903.1 mod

Analyte	CAS Number	Project Action Limit[1] Goal (pCi/g)	Project Action Limit Goal Reference[1]	Project Quantitation Limit Goal[2] (pCi/g)	Laboratory-specific Limits[3,4,5,]	
					MDC (pCi/g)	MDL (pCi/g)
Radium-226[6]	13982-63-3	1.0 pCi/g above background	Parcel B ROD RG	0.3	0.3	NA

Notes:

[1]These values are based on those provided in the *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009). The project action limit is the RG value provided in the Parcel B ROD or the background concentration, whichever is higher.
[2]Project QL goals for individual samples are equal to the MDC and will be a maximum of 90 percent of the RG.
[3] Results for non-aqueous samples are reported on a dry-weight basis.
[4]The MDC is an estimate of the smallest true activity (or activity concentration) of an analyte in a sample that ensures a 95 percent probability of detection, give a detection criterion that includes a 5 percent probability of detection in an analyte-free sample. MDCs may vary from sample to sample depending on the composition of the sample matrix. Any changes to these limits that affect the project SAP objectives must be approved by the Navy RPM and QAO in writing in advance of sample testing.
[5]The SOPs reflect standard method MDCs that are the default values if a project does not specify a site-specific detection limit. The MDC listed in this worksheet can be achieved with larger aliquots or longer count times within the constraints of the method in order to achieve project objectives. MDC is the minimum detectable concentration, which is an equivalent calculation to the MDA.
[6]Radium-226 background will be established as described in the Parcel B Work Plan.

SAP Worksheet #15.5 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)

Analytical Group: Chemical (volatile organic compounds [VOCs]) – USEPA Method 8260B

Analyte	CAS Number	Project Screening Limit[4] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific Limits		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
1,1,1,2-Tetrachloroethane	630-20-6	2,000	EPA Residential RSL[1]	950	5.0	2.0	1.548
1,1,1-Trichloroethane	71-55-6	8,100,000	EPA Residential RSL[1]	4,350,000	5.0	2.0	1.623
1,1,2,2-Tetrachloroethane	79-34-5	600	EPA Residential RSL[1]	280	5.0	2.0	1.255
1,1,2-Trichloroethane	79-00-5	1,100	EPA Residential RSL[1]	550	7.5	2.0	1.061
1,1-Dichloroethane	75-34-3	3,600	EPA Residential RSL[1]	1,650	5.0	2.0	1.711
1,1-Dichloroethene	75-35-4	230,000	EPA Residential RSL[1]	120,000	5.0	2.0	1.391
1,2,3-Trichlorobenzene	87-61-6	63,000	EPA Residential RSL[1]	31,000	5.0	2.0	1.131
1,2,3-Trichloropropane	96-18-4	5.1	EPA Residential RSL[1]	5[2]	5.0	2.0	1.228
1,2,4-Trichlorobenzene	120-82-1	24,000	EPA Residential RSL[1]	11,000	5.0	2.0	0.918
1,2,4-Trimethylbenzene	95-63-6	300,000	EPA Residential RSL[1]	150,000	5.0	2.0	1.035
1,2-Dibromo-3-chloropropane	96-12-8	5.3	EPA Residential RSL[1]	7.5[5]	7.5	5.0	2.486
1,2-Dibromoethane (EDB)	106-93-4	36	EPA Residential RSL[1]	17	5.0	2.0	0.930
1,2-Dichlorobenzene	95-50-1	1,800,000	EPA Residential RSL[1]	950,000	5.0	2.0	1.307
1,2-Dichloroethane	107-06-2	460	EPA Residential RSL[1]	230	5.0	2.0	1.325
1,2-Dichloropropane	78-87-5	2,500	EPA Residential RSL[1]	1,200	5.0	2.0	1.187
1,3,5-Trimethylbenzene	108-67-8	270,000	EPA Residential RSL[1]	135,000	5.0	2.0	1.074
1,3-Dichloropropane	142-28-9	1,600,000	EPA Residential RSL[1]	800,000	5.0	2.0	1.252
1,4-Dichlorobenzene	106-46-7	2,600	EPA Residential RSL[1]	1,300	5.0	2.0	1.178
2-Butanone	78-93-3	27,000,000	EPA Residential RSL[1]	14,000,000	10.0	5.0	2.104
2-Chlorotoluene	95-49-8	1,600,000	EPA Residential RSL[1]	800,000	5.0	2.0	1.038
2-Hexanone	591-78-6	200,000	EPA Residential RSL[1]	105,000	5.0	2.0	1.378
4-Chlorotoluene	106-43-4	1,600,000	EPA Residential RSL[1]	800,000	5.0	2.0	1.157
4-Methyl-2-pentanone	108-10-1	33,000,000	EPA Residential RSL[1]	16,500,000	7.5	2.0	2.043
Acetone	67-64-1	61,000,000	EPA Residential RSL[1]	30,500,000	25.0	10.0	7.286

SAP Worksheet #15.5 – Reference Limits and Evaluation Table (continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (volatile organic compounds [VOCs]) – USEPA Method 8260B

Analyte	CAS Number	Project Screening Limit (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
Benzene	71-43-2	1,200	EPA Residential RSL[1]	600	5.0	2.0	1.128
Bromobenzene	108-86-1	290,000	EPA Residential RSL[1]	150,000	5.0	2.0	1.665
Bromochloromethane	74-97-5	150,000	EPA Residential RSL[1]	80,000	7.5	2.0	1.703
Bromodichloromethane	75-27-4	290	EPA Residential RSL[1]	135	5.0	2.0	0.920
Bromoform	75-25-2	19,000	EPA Residential RSL[1]	9,500	7.5	2.0	2.092
Bromomethane	74-83-9	6,800	EPA Residential RSL[1]	3,650	5.0	2.0	1.723
Carbon disulfide	75-15-0	770,000	EPA Residential RSL[1]	410,000	5.0	2.0	1.129
Carbon tetrachloride	56-23-5	650	EPA Residential RSL[1]	305	5.0	2.0	0.913
Chlorobenzene	108-90-7	280,000	EPA Residential RSL[1]	145,000	5.0	2.0	1.494
Chloroform	67-66-3	320	EPA Residential RSL[1]	145	5.0	2.0	1.016
Chloromethane	74-87-3	110,000	EPA Residential RSL[1]	60,000	5.0	2.0	1.191
cis-1,2-Dichloroethene	156-59-2	160,000	EPA Residential RSL[1]	80,000	5.0	2.0	1.233
Dibromochloromethane	124-48-1	8,300	EPA Residential RSL[1]	4,100	5.0	2.0	0.963
Dibromomethane	74-95-3	24,000	EPA Residential RSL[1]	12,000	5.0	2.0	1.020
Dichlorodifluoromethane (Freon 12)	75-71-8	87,000	EPA Residential RSL[1]	47,000	5.0	2.0	1.478
Ethylbenzene	100-41-4	5,800	EPA Residential RSL[1]	2,700	5.0	2.0	1.300
Hexachlorobutadiene	87-68-3	1,200	EPA Residential RSL[1]	600	5.0	2.0	1.603
Methyl tert-Butyl ether (MTBE)	1634-04-4	47,000	EPA Residential RSL[1]	21,500	5.0	2.0	2.0
Methylene chloride	75-09-2	57,000	EPA Residential RSL[1]	28,000	5.0	2.0	1.763
m,p-Xylenes	179601-23-1	550,000	EPA Residential RSL[1]	275,000	10.0	4.0	2.685
o-Xylene	95-47-6	650,000	EPA Residential RSL[1]	345,000	5.0	2.0	1.167

SAP Worksheet #15.5 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (volatile organic compounds [VOCs]) – USEPA Method 8260B

Analyte	CAS Number	Project Screening Limit (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
n-Butylbenzene	104-51-8	3,900,000	EPA Residential RSL[1]	1,950,000	5.0	2.0	0.953
n-Propylbenzene	103-65-1	3,800,000	EPA Residential RSL[1]	1,100,000	5.0	2.0	1.173
Styrene	100-42-5	6,000,000	EPA Residential RSL[1]	3,000,000	5.0	2.0	1.208
Tetrachloroethene	127-18-4	480	Parcel B ROD RG[3] (RBC)	240	5.0	2.0	1.086
Toluene	108-88-3	4,900,000	EPA Residential RSL[1]	2,500,000	5.0	2.0	1.465
trans-1,2-Dichloroethene	156-60-5	1,600,000	EPA Residential RSL[1]	75,000	7.5	2.0	1.866
trans-1,3-Dichloropropene	10061-02-6	1,800	EPA Residential RSL[1]	850	5.0	2.0	1.365
Trichloroethene	79-01-6	2,900	Parcel B ROD RG[3] (RBC)	1,400	5.0	2.0	1.343
Trichlorofluoromethane (Freon 11)	75-69-4	23,000,000	EPA Residential RSL[1]	11,000,000	5.0	2.0	1.147
Vinyl chloride	75-01-4	59	EPA Residential RSL[1]	29	5.0	2.0	1.766

Notes:
[1]Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2020.
[2] The LOQ is equal to or exceeds the comparison criteria; therefore, the LOQ will be used as the criterion for decision-making. Non-detects will be reported to the LOD.
[3]Remediation goals from the Final Amended Parcel B ROD (Navy, 2009). Units (mg/kg) presented in the ROD have been converted to the units (µg/kg) the laboratory will use to report the data.
[4]Results will be reported on a dry-weight basis for comparison to the Project Screening limits.
[5]The LOQ does not meet the PSL; however, the DL and the LOD are sufficient to meet the PSL. Non-detects will be reported to the LOD.

DL = detection limit
USEPA = U.S. Environmental Protection Agency
LOD =limit of detection
LOQ = limit of quantitation
RBC = risk-based criterion
RG = remediation goal
ROD = Record of Decision
RSL = Regional Screening Level
ug/kg = microgram per kilogram
VOC = volatile organic compound

SAP Worksheet #15.6 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (semivolatile organic compounds [SVOCs]) - EPA Method 8270D

Analyte	CAS Number	Project Screening Limit[3] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
2,4,5-Trichlorophenol	95-95-4	6,300,000	EPA Residential RSL[1]	3,100,000	50	30	18
2,4,6-Trichlorophenol	88-06-2	49,000	EPA Residential RSL[1]	24,000	50	30	23
2,4-Dichlorophenol	120-83-2	190,000	EPA Residential RSL[1]	80,000	50	30	28
2,4-Dimethylphenol	105-67-9	1,300,000	EPA Residential RSL[1]	600,000	50	40	67
2,4-Dinitrophenol	51-28-5	130,000	EPA Residential RSL[1]	60,000	60	50	49
2,4-Dinitrotoluene	121-14-2	1,700	EPA Residential RSL[1]	800	50	30	30
2,6-Dinitrotoluene	606-20-2	360	EPA Residential RSL[1]	130	50	30	28
2-Chloronaphthalene	91-58-7	4,800,000	EPA Residential RSL[1]	2,400,000	50	40	33
2-Chlorophenol	95-57-8	390,000	EPA Residential RSL[1]	195,000	50	40	38
2-Nitroaniline	88-74-4	630,000	EPA Residential RSL[1]	310,000	50	30	31
3,3'-Dichlorobenzidine	91-94-1	1,200	EPA Residential RSL[1]	667	60	50	46
4-Chloroaniline	106-47-8	2,700	EPA Residential RSL[1]	1,200	50	40	38
4-Nitroaniline	100-01-6	27,000	EPA Residential RSL[1]	12,000	50	30	23
Benzoic acid	65-85-0	250,000,000	EPA Residential RSL[1]	120,000,000	50	30	120
Benzyl alcohol	100-51-6	6,300,000	EPA Residential RSL[1]	3,100,000	50	40	40
bis(2-Chloroethoxy)methane	111-91-1	190,000	EPA Residential RSL[1]	95,000	50	40	38
bis(2-Chloroethyl)ether	111-44-4	230	EPA Residential RSL[1]	100	50	40	38
bis(2-Ethylhexyl)phthalate	117-81-7	1,100	Parcel B ROD RG[3] (RBC)	550	60	50	41
Dibenzofuran	132-64-9	73,000	EPA Residential RSL[1]	36,000	50	30	26
Diethylphthalate	84-66-2	51,000,000	EPA Residential RSL[1]	25,000,000	50	30	25
Di-n-butylphthalate	84-74-2	6,300,000	EPA Residential RSL[1]	3,100,000	60	50	41
Hexachlorobenzene	118-74-1	210	EPA Residential RSL[1]	100	50	30	24
Hexachlorobutadiene	87-68-3	1,200	EPA Residential RSL[1]	600	50	40	37

SAP Worksheet #15.6 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (semivolatile organic compounds [SVOCs]) - EPA Method 8270D

Analyte	CAS Number	Project Screening Limit[4] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
Hexachloroethane	67-72-1	1,800	EPA Residential RSL[1]	600	50	40	39
Isophorone	78-59-1	570,000	EPA Residential RSL[1]	280,000	50	40	42
Nitrobenzene	98-95-3	5,100	EPA Residential RSL[1]	2,400	50	40	42
n-Nitrosodiphenylamine	86-30-6	110,000	EPA Residential RSL[1]	49,500	50	30	29
n-Nitroso-di-n-propylamine	621-64-7	780,000	EPA Residential RSL[1]	390,000	50	40	33
Pentachlorophenol	87-75-4	1,000	EPA Residential RSL[1]	500	50	40	35
Phenol	108-95-2	19,000,000	EPA Residential RSL[1]	9,000,000	50	30	34

Notes:
[1]Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2020.
[2]Remediation goal from the Final Amended Parcel B ROD (Navy, 2009). Units (milligrams per kilogram [mg/kg]) presented in the ROD have been converted to the units (µg/kg) the laboratory will use to report the data.
[3]Results will be reported on a dry-weight basis for comparison to the Project Screening limits.

DL= detection limit
USEPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
PAH = polycyclic aromatic hydrocarbon
PQL = project quantitation limit
RBC = risk-based criteria
RG = remediation goal
ROD = record of decision
RSL = regional screening level
ug/kg = micrograms per kilogram

SAP Worksheet #15.7 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (polyaromatic hydrocarbons [PAHs]) – USEPA 8270SIM

Analyte	CAS Number	Project Screening Limit[3] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
Acenaphthene	83-32-9	3,600,000	EPA Residential RSL[1]	1,800,000	10	1.07	0.32
Anthracene	120-12-7	18,000,000	EPA Residential RSL[1]	9,000,000	10	4.33	1.44
Benzo(a)anthracene	56-55-3	370	Parcel B ROD RG[2] (RBC)	180	10	4.33	1.8
Benzo(a)pyrene	50-32-8	330	Parcel B ROD RG[2] (PQL)	150	10	4.33	1.48
Benzo(b)fluoranthene	205-99-2	340	Parcel B ROD RG[2] (RBC)	170	10	6.67	2.4
Benzo(k)fluoranthene	207-08-9	340	Parcel B ROD RG[2] (RBC)	170	10	4.33	2.0
Chrysene	218-01-9	110,000	EPA Residential RSL[1]	55,000	10	4.33	2.0
Dibenz(a,h)anthracene	53-70-3	330	Parcel B ROD RG[2] (PQL)	150	10	6.67	2.6
Fluoranthene	206-44-0	2,400,000	EPA Residential RSL[1]	1,200,000	10	4.33	2.0
Fluorene	86-73-7	2,400,000	EPA Residential RSL[1]	1,200,000	10	2.67	0.94
Indeno(1,2,3-cd)pyrene	193-39-5	350	Parcel B ROD RG[2] (RBC)	170	10	6.67	2.2
2-Methylnaphthalene	91-57-6	240,000	EPA Residential RSL[1]	120,000	10	2.0	0.62
Naphthalene	91-20-3	1,700	Parcel BROD RG[2] (RBC)	850	10	2.0	0.65
Pyrene	129-00-0	1,800,000	EPA Residential RSL[1]	900,000	10	6.67	2.2

Notes:
[1]Values are from the EPA Region 9 Regional Screening Level for Residentail Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2020.
[2] Remediation goals from the Final Amended Parcel B ROD (Navy, 2009). Units (mg/kg) presented in the ROD have been converted to the units (µg/kg) the laboratory will use to report the data.
[3]Results will be reported on a dry-weight basis for comparison to the Project Screening limits.

SAP Worksheet #15.7 – Reference Limits and Evaluation Table

Notes (Continued):
DL= detection limit
USEPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
PAH = polycyclic aromatic hydrocarbon
PQL = practical quantitation limit
RBC = risk-based criteria
RG = remediation goal
ROD = record of decision
RSL = regional screening level
ug/kg = micrograms per kilogram

SAP Worksheet #15.8 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (polychlorinated biphenyls [PCBs]) – EPA Method 8082A

Analyte	CAS Number	Project Screening Limit[3] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
Aroclor 1016	12674-11-2	4,100	EPA Residential RSL[1]	2,000	3.3	1.7	1.073
Aroclor 1221	11104-28-2	200	EPA Residential RSL[1]	100	3.3	1.7	1.073
Aroclor 1232	11141-16-5	170	EPA Residential RSL[1]	85	3.3	1.7	1.073
Aroclor 1242	53469-21-9	230	EPA Residential RSL[1]	110	3.3	1.7	1.073
Aroclor 1248	12672-29-6	230	EPA Residential RSL[1]	110	3.3	1.7	1.073
Aroclor 1254	11097-69-1	93	Parcel B ROD RG[2] (RBC)	47	3.3	1.7	1.073
Aroclor 1260	11096-82-5	210	Parcel B ROD RG[2] (RBC)	100	3.3	1.7	1.025

Notes:
[1]Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2020.
[2] Remediation goals from the Final Amended Parcel B ROD (Navy, 2009). Units (mg/kg) presented in the ROD have been converted to the units (µg/kg) the laboratory will use to report the data.
[3]Results will be reported on a dry-weight basis for comparison to the project screening limits.
USEPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
PCBs = polychlorinated biphenyls
RBC = risk-based criterion
RG = remediation goal
ROD = record of decision
RSL = regional screening level
ug/kg = micrograms per kilogram

SAP Worksheet #15.9 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (pesticides) – USEPA Method 8081B

Analyte	CAS Number	Project Screening Limit[4] (ug/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific		
					LOQ (ug/kg)	LOD (ug/kg)	DL (ug/kg)
4,4'-DDD	72-55-9	1,900	EPA Residential RSL[1]	1,000	3.4	2.67	1.09
4,4'-DDE	72-54-8	2,000	EPA Residential RSL[1]	1,000	3.4	1.33	0.48
4,4'-DDT	50-29-3	1,900	EPA Residential RSL[1]	1,000	4.0	2.67	1.18
Aldrin	309-00-2	39	EPA Residential RSL[1]	20	3.4	1.33	0.50
alpha-BHC	319-84-6	86	EPA Residential RSL[1]	43	3.4	1.33	0.49
beta-BHC	319-85-7	6.6	Parcel B ROD RG[2] (PQL)[3]	4.0	4.0	4.0	1.33
Chlordane (mixture of isomers)	57-74-9	NE	Not Applicable	10	3.4	1.33	0.65
Dieldrin	60-57-1	3.4	Parcel B ROD RG[2] (PQL)[3]	3.4[3]	3.4	1.33	0.42
Endosulfan I	959-98-8	470,000	EPA RSL[1] for Endosulfan	235,000	3.4	1.0	0.35
Endosulfan II	33213-65-9	470,000	EPA RSL[1] for Endosulfan	235,000	3.4	1.33	0.57
Endrin	72-20-8	19,000	EPA Residential RSL[1]	9,000	3.4	1.33	0.61
gamma-BHC (Lindane)	58-89-9	570	EPA Residential RSL[1]	280	3.4	2.67	0.93
Heptachlor	76-44-8	130	EPA Residential RSL[1]	65	3.4	1.33	0.42
Heptachlor epoxide	1024-57-3	1.7	Parcel B ROD RG[2] (PQL)[3]	3.4[3]	3.4	2.67	0.85
Methoxychlor	72-43-5	320,000	EPA Residential RSL[1]	160,000	6.6	2.67	0.90
Toxaphene	8001-35-2	490	EPA Residential RSL[1]	240	340	93.3	31.6

[1]Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2020.
[2] Remediation goals from the Final Amended Parcel B ROD (Navy, 2009). Units (mg/kg) presented in the ROD have been converted to the units (µg/kg) the laboratory will use to report the data.
[3]The PQL exceeds the RBC; therefore, the PQL will be used as the criterion for decision-making. The PQL is deemed acceptable for decision-making purposes.
[4]Results will be reported on a dry-weight basis for comparison to the Project Screening limits.

SAP Worksheet #15.10 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (total petroleum hydrocarbons as gasoline range organics, diesel range organics, and motor oil) – USEPA 8015 Modified

Analyte	CAS Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
TPH as gasoline range organics (C6-C10)	-3524[1]	100	2019 ESLs[2]	50	1.2	1.1	0.325
TPH as diesel range organics (C10-C24)	68334-30-5	260	2019 ESLs[2]	130	8.0	4.0	1.36
TPH as motor oil range organics (C24-C36)	-3546[1]	1,600	2019 ESLs[2]	800	24.0	23.4	7.82

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2] Tier 1 Environmental Screening Levels (ESLs); San Francisco Bay Regional Water Quality Control Board, January 2019, Rev. 2.
[3]Results will be reported on a dry-weight basis for comparison to the project screening limits.
TPH= total petroleum hydrocarbons
mg/kg = milligrams per kilogram

SAP Worksheet #15.11 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemical (metals) - USEPA Method 6020B/6010D/7471A)

Analyte	CAS Number	Project Screening Limit[5] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aluminum	7429-90-5	77,000	EPA Residential RSL[1]	38,500	10	2	1.974
Antimony	7440-36-0	10	Parcel B ROD RG[2] (RBC)	5	1.0	0.500	0.103
Arsenic	7440-38-2	11.1	Parcel B ROD RG[2] (HPAL)	5.5	1.0	0.500	0.255
Barium	7440-39-3	314.4	HPAL[3]	150	1.0	0.500	0.191
Beryllium	7440-41-7	0.71	HPAL[3]	0.35	1.0	0.500	0.155
Cadmium	7440-43-9	3.5	Parcel B ROD RG[2] (RBC)	1.7	1.0	0.500	0.112
Chromium	7440-47-3	120,000	EPA RSL for Chromium (III), Insoluble Salts[1]	60,000	1.0	0.500	0.304
Cobalt	7440-48-4	--[4]	HPAL[3]	12	0.500	0.100	0.085
Copper	7440-50-8	159	Parcel B ROD RG[2] (RBC)	80	1.0	0.500	0.155
Iron	7439-89-6	58,000	Parcel B ROD RG[2] (HPAL)	29,000	25	10	6.902
Lead	7439-92-1	155	Parcel B ROD RG[2] (RBC)	78	0.500	0.100	0.086
Manganese	7439-96-5	1,431	Parcel B ROD RG[2] (HPAL)	720	15	5	3.648
Mercury	7439-97-6	2.3	Parcel B ROD RG[2] (HPAL)	1.2	0.01	0.002	0.0019
Molybdenum	7439-98-7	2.68	HPAL[3]	1.3	0.500	0.100	0.087
Nickel	7440-02-0	1,500	EPA Residential RSL[1] for Nickel, Soluble Salts	750	1.0	0.500	0.160
Selenium	7782-49-2	1.95	HPAL[3]	0.98	5	1	0.718
Silver	7440-22-4	1.43	HPAL[3]	0.72	0.500	0.200	0.107
Sodium	7758-19-2	2,300	EPA RSL[1] for Sodium Salt	1,100	50	15	10.008
Thallium	7440-28-0	0.81	HPAL[3]	0.5	0.500	0.100	0.083
Vanadium	7440-62-2	117	Parcel B ROD RG[2] (HPAL)	59	5	1	0.644
Zinc	7440-66-6	373	Parcel B ROD RG[2] (RBC)	190	20	10	5.921

SAP Worksheet #15.11 – Reference Limits and Evaluation Table

Notes:
[1]Values are from the EPA Region 9 Regional Screening Level for Industrial Soil as presented in the Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) November 2018.
[2] Remediation goals from the Final Amended Parcel B ROD (Navy, 2009).
[3]PRC Environmental Management, Inc. (PRC). 1995. "Calculation of Hunters Point Ambient Levels (HPAL), Hunters Point Annex, San Francisco, California"
[4]Sample-specific HPAL will be calculated based on the approved HPNS cobalt/magnesium regression-based relationship (PRC, 1995).
[5]Results will be reported on a dry-weight basis for comparison to the project screening limits.
HPAL= Hunters Point ambient level

SAP Worksheet #15.12 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Asbestos (polarized light microscopy [PLM]) by USEPA Method 600/R-93/116

Analyte	CAS Number	Project Screening Limit (percent)[1]	Project Screening Limit Reference	Project Quantitation Limit Goal (percent)	Laboratory-specific		
					LOQ (percent)	LOD (percent)	DL (percent)
Asbestos	132207-33-1	0.25	DTSC[2]	0.25	0.25	--	1 fiber

Notes:
[1] Assumes analysis will be performed by polarized light microscope with a 400-point count. A non-detect shall be an acceptable analytical result.
[2]Screening level for naturally occurring asbestos at school sites (Department of Toxic Substances Control, 2004).
PLM = polarized light microscopy

SAP Worksheet #15.13 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Chemistry (pH) by USEPA Method 9045D

Analyte	CAS Number	Project Screening Limit (pH Units)	Project Screening Limit Reference	Project Quantitation Limit Goal (pH Units)	Laboratory-specific		
					LOQ (pH Units)	LOD (pH Units)	DL (pH Units)
pH	-9[1]	6.5 < pH < 8.5	SFRWQCB[2]	0.1	0.01	0.01	0.01

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2]Remediation goal from the *San Francisco Bay (Region 2) Water Quality Control Plan (Basin Plan)* (Water Board, 2011).

SAP Worksheet #15.14 – Reference Limits and Evaluation Table

Matrix: Soil (testing of imported fill material)
Analytical Group: Radiochemistry (gamma spectroscopy and gas flow proportional counting) – USEPA Method 901.1M and 905.0M

Analyte[1,2]	CAS Number	Project Screening Limit[4] (pCi/g)	Project Screening Limit Reference	Project Quantitation Limit Goal (pCi/g)	Laboratory-specific[1,2,3]	
					MDC (pCi/g)	MDL (pCi/g)
Cesium-137	10045-97-3	0.113	Parcel B ROD RG[5]	0.08	0.07	NA
Radium-226	13982-63-3	1.0 pCi/g above background[6]	Parcel B ROD RG[5]	0.7	0.4	NA
Strontium-90	10098-97-2	0.331	Parcel B ROD RG[5]	0.25	0.25	NA
Actinium-228	14331-83-0	None	None	1.69	0.5	NA
Bismuth-214	14913-49-6	None	None	0.7	0.5	NA
Lead-214	15067-28-4	None	None	0.2	0.2	NA
Potassium-40	13966-00-2	None	None	1.2	1.2	NA
Bismuth-212	14913-49-6	None	None	0.7	0.7	NA
Lead-212	15092-94-1	None	None	0.2	0.2	NA
Americium-241	14596-10-2	None	None	0.2	0.2	NA
Cobalt-60	10198-40-0	0.0361	Parcel B ROD RG[5]	0.07[3]	0.1	NA
Europium-152	14683-23-9	None	None	0.4	0.4	NA
Europium-154	15585-10-1	None	None	0.2	0.2	NA
Protactinium-234	15100-28-4	None	None	0.2	0.2	NA
Lead-210	14255-04-0	None	None	2.0	2.0	NA
Thorium-232	7440-29-1	None	None	0.5	0.5	NA
Thorium-234	15065-10-8	None	None	2.0	2.0	NA
Thallium-208	14913-50-9	None	None	0.1	0.1	NA

Notes:

[1] The isotope list above will be used for samples that have undergone an in-growth period; radium-226 will be reported based on the 609 keV bismuth-214 gamma energy peak.

[2] All detected radionuclides will be reported.

[3] An MDC of 0.07 pCi/g represents a count time of 6 hours.

[4] Results for non-aqueous samples are reported on a dry-weight basis.

[5] *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009)

[6] Remediation goal is 1 pCi/g above background per agreement with EPA (established in *Final Basewide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California*, dated April 21, 2006), and is consistent with the radiological-related remedies selected in the ROD for Parcel B.

pCi/g = picocuries per gram

SAP Worksheet #15.15 – Reference Limits and Evaluation Table

Matrix: Water
Analytical Group: Radiological (gamma spectroscopy) - USEPA Method 901.1

Analyte	CAS Number	Project Remediation Goal[4] (pCi/L)	Project Remediation Goal Limit Reference	Project Quantitation Limit Goal (pCi/L)	Laboratory-specific Limits[1,2,3]	
					MDC(pCi/L)	MDL (pCi/L)
Cesium-137	10045-97-3	119	Parcel B ROD RG[5]	5	5	NA
Radium-226	13982-63-3	5.0[6]	Parcel B ROD RG[5]	60	60	NA
Bismuth-214	14913-49-6	None	None	10	10	NA
Lead-214	15067-28-4	None	None	10	10	NA
Potassium-40	13966-00-2	None	None	45	45	NA
Actinium-228	14331-83-0	None	None	25	25	NA
Bismuth-212	14913-49-6	None	None	20	20	NA
Lead-212	15092-94-1	None	None	5	5	NA
Americium-241	14596-10-2	None	None	10	10	NA
Cobalt-60	10198-40-0	100	Parcel B ROD RG	5	5	NA
Europium-152	14683-23-9	None	None	10	10	NA
Europium-154	15585-10-1	None	None	5	5	NA
Protactinium-234	15100-28-4	None	None	10	10	NA
Lead-210	14255-04-0	None	None	65	65	NA
Thorium-232	7440-29-1	None	None	25	25	NA
Thorium-234	15065-10-8	None	None	45	45	NA
Thallium-208	14913-50-9	None	None	5	5	NA

SAP Worksheet #15.15 – Reference Limits and Evaluation Table (Continued)

Notes:

[1] The isotope list above will be used for samples that have undergone an in-growth period; radium-226 will be reported based on the 609 keV bismuth-214 gamma energy peak.

[2] All detected radionuclides will be reported.

[3] An MDC of 0.07 pCi/g represents a count time of 6 hours.

[4] Results for non-aqueous samples are reported on a dry-weight basis.

[5] *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009)

[6] Goal is for total radium concentration. ^{226}Ra MDC does not meet project remediation goal by gamma spectroscopy; therefore, it will be reported by alpha spectroscopy.

SAP Worksheet #15.16 – Reference Limits and Evaluation Table

Matrix: Water
Analytical Group: Radiological (gas flow proportional counting) – USEPA Method 905.0M

Analyte	CAS Number	Project Remediation Goal (pCi/L)	Project Remediation Goal Reference	Project Quantitation Limit Goal (pCi/L)	Laboratory-specific Limits	
					MDC (pCi/g)	MDL (pCi/g)
Strontium-90	10098-97-2	8.0	Parcel B ROD RG[2]	5	5	NA
Total Strontium[1]	7440-24-6	8.0	NA	5	5	NA

Notes:
[1] Total strontium analysis will be performed first by the laboratory. If the total strontium result is less than the Project Quantitation Limit Goal no additional analysis will be required. However, if the total strontium result is above the Project Quantitation Limit Goal, then ^{90}Sr-specific analysis may be performed to establish a specific ^{90}Sr concentration.
[2] *Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009)

SAP Worksheet #15.17 – Reference Limits and Evaluation Table

Matrix: Water
Analytical Group: Radiological (alpha spectroscopy) – USDOE Method HASL 300 Pu-02 RC Modified and HASL 300 SE-03 Modified

Analyte[1,2]	CAS Number	Project Remediation Goal (pCi/L)	Project Remediation Goal Reference	Project Quantitation Limit Goal (pCi/L)	Laboratory-specific Limits	
					MDC (pCi/L)	MDL (pCi/L)
Radium-226	13982-63-3	5.0	Parcel B ROD RG[1]	1.0	1.0	NA
Plutonium-239	7440-07-5	15	Parcel B ROD RG[1]	1.0	1.0	NA
Uranium-234	13966-29-5	None	None	1.0	1.0	NA
Uranium-235	15117-96-1	None	None	1.0	1.0	NA
Uranium-238	7440-61-1	None	None	1.0	1.0	NA
Thorium-228	14274-82-9	None	None	1.0	1.0	NA
Thorium-230	14269-63-7	None	None	1.0	1.0	NA
Thorium-232	7740-29-1	None	None	1.0	1.0	NA

Notes:
[1]*Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California* (Navy, 2009)

SAP Worksheet #16 – Project Schedule /Timeline Table
(UFP-QAPP Manual Section 2.8.2)

The project schedule is included as **Figure 16-1** of this SAP.

SAP Worksheet #17 – Sampling and Survey Design and Rationale

The proposed Parcel B Evaluation survey, sampling, and analytical program, as well as the rationale for selecting sample locations, is described below.

17.1 Soil Investigation

This section describes the design of radiological investigations, including gamma scanning and soil sample collection in soil. The radiological investigation design and rationale are primarily based on methods, techniques, and instrument systems in the *Basewide Radiological Management Plan* (TtEC, 2012), with the ultimate requirement to demonstrate compliance with the Parcel B ROD RAO (Navy, 2009).

A two-phased approach is planned for the investigation for surface and subsurface TU soil associated with former sanitary and storm drain lines. The approach is based on a proposal by the regulatory agencies to achieve a high level of confidence that the Parcel B ROD RAO has been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 33 percent of TUs in Parcel B. Soil sampling and scanning at the remaining 67 percent of TUs will be performed as part of Phase 2 to increase confidence that current site conditions comply with the Parcel B ROD RAO. The Navy will re-excavate 100 percent of Phase 2 TUs if contamination is identified in Phase 1 TUs. For surface soil areas associated with soil from building sites, radiological investigation will be conducted at SUs as listed in **Worksheet #18** in Parcel B. The name, size, and boundary of the TUs and SUs will be based on the previous plans and reports.

The ROCs for the soil areas are listed in **Table 17-1**, and RGs are listed in **Worksheets #15.1**, **#15.2, and #15.3**. Samples collected in support of the TU and SU investigation are provided in this worksheet.

Table 17-1. Soil Radionuclides of Concern

Soil Area	Radionuclide of Concern
Former Sanitary Sewer and Storm Drain Lines	^{137}Cs, ^{226}Ra, ^{90}Sr
Buildings 103, 114, 142, and 157	^{137}Cs, ^{60}Co[a], ^{226}Ra, ^{90}Sr, ^{239}Pu

[a] ^{60}Co is a ROC only for Building 157, whose most recent documented use as an industrial laboratory was 1984 (HRA Table 3-4); therefore ^{60}Co (half-life = 5.26 years) has undergone decay of nearly seven half-lives.

Analysis will be based on the site-specific ROCs listed in **Table 17-1**. All soil samples will be analyzed by gamma spectroscopy for ^{226}Ra and ^{137}Cs with at least 10 percent of randomly selected samples receiving gas flow proportional analysis for ^{90}Sr.

- A minimum of 10 percent of randomly selected samples collected from the Buildings 103, 140, and 142 Sites will be randomly selected for alpha spectroscopy analysis for ^{239}Pu.

Gamma spectroscopy data will be reported by the laboratory after a full 21-day in-growth period. If the laboratory results indicate a concentration of ^{226}Ra above the RG

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(**Worksheet #15.1**), the sample will be analyzed using alpha spectroscopy for uranium isotopes (^{238}U, ^{235}U, and ^{234}U), thorium isotopes (^{232}Th, ^{230}Th, and ^{228}Th), and ^{226}Ra. If the laboratory results indicate concentrations of ^{137}Cs above its RG (**Worksheet #15.1**), the sample will be analyzed for ^{90}Sr and by alpha spectroscopy for ^{239}Pu. If the laboratory results indicate the presence of concentrations of ^{90}Sr at or above the respective RG (**Worksheet #15.2**), the sample will be analyzed by alpha spectroscopy for ^{239}Pu (**Worksheet #15.3**).

Soil samples will be collected on a systematic sampling grid or biased to locations identified by the gamma scanning surveys. The number of systematic soil samples collected will be based on the guidance described in MARSSIM Section 5.5.2.2 (USEPA et al., 2000) using ^{226}Ra as the example basis for calculating the minimum sample frequency. Even if the MARSSIM-recommended or other statistical tests are not used to evaluate site data, these calculations serve as a basis for determining the number of samples per SU to be collected. The number of biased samples will be determined based on results of scan surveys, and a minimum of one biased sample will be collected in every TU and SU.

The methods for calculating the number of samples in an SU are provided in the Parcel B Work Plan. ~~Twenty-five samples are recommended as a placeholder until data from the RBA study become available.~~ The minimum number of samples per SU will be developed based on the variability observed in the RBA data. A retrospective power curve will be prepared to demonstrate that the number of samples from each SU was sufficient to meet the project objectives. If necessary, additional samples may be collected to comply with the project objectives.

Phase 1 Trench Unit

Phase 1 includes the radiological investigation on a targeted group of 24 of the 70 TUs associated with the former sanitary sewer and storm drain lines (**Figure 3-1** and **Worksheet #18**) to evaluate whether concentrations of ROCs are compliant with the RAO in the Parcel B ROD (Navy, 2009). The former TUs selected for Phase 1 investigation were based on their location adjacent to (i.e., downstream and upstream from) impacted buildings. The Phase 1 TUs will be re-excavated to the previous excavation limits by making reasonable attempts to ensure accuracy in relocating the former TU boundaries. Excavated material from ESUs and SFUs will be maintained separately (**Worksheet #14**). If the investigation results demonstrate potential exceedances of the RGs or background, whichever is higher, the material will be segregated for further evaluation as described in the Parcel B Work Plan. An in situ investigation and/or remediation of the trench sidewalls and floor will be performed prior to backfill. An example Phase 1 TU location is presented on **Figure 3-3**.

Excavated TU material (ESUs and SFUs) will be assayed using the RSY process. The objective of the processing activities on the RSY pads is the characterize the material. Material that meets the RGs identified in **Worksheet #15.1** will be used as backfill

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material or shipped offsite as non-LLRW. The RSY pad investigation will include gamma scans over 100 percent of the surface area and systematic and biased soil sampling.

A minimum of 18 systematic samples will be collected. Data obtained during the surface gamma scan surveys, including gross gamma and individual radionuclide spectral measurements, will be analyzed to identify areas where surface radiation levels appear to be greater than the radionuclide-specific investigation levels using regions of interest-peak identification tools.

Elevated areas will be noted on a survey map and flagged in the field for verification. Biased samples will be collected from potential areas of elevated activity displaying gamma scan survey results greater than the investigation level, as described in the Parcel B Work Plan. Each 1,000 m^2 RSY pad area will be plotted using VSP software (or equivalent) to determine the location of the 18 systematic soil samples. Soil samples will be collected from the surface at a depth of 0 to 6 inches.

If gamma scan surveys or soil sampling indicate areas of potentially elevated activity in soil material originating from an SFU, an in situ investigation of the open trench will be performed at the excavation location of the soil. The SFU in situ investigation will include the performance of a gamma scan over the trench surface requiring investigation and additional biased and systematic sampling. The gamma scan will be performed in two stages. The first stage is a 100 percent gamma scan of the accessible areas. Review of the gamma scan data will determine whether further investigation is warranted. If further investigation is not warranted, the second stage is not necessary, and systematic samples will be collected. If further investigation is warranted, biased samples may be collected. A minimum of 18 systematic soil samples will be collected from each SFU requiring investigation. Each 1,000 m^2 trench SFU will be plotted using VSP software (or equivalent) to determine the location of the 18 systematic soil samples. The systematic soil samples will be plotted using a random start square grid using the VSP software (or equivalent). Soil samples will be collected from the trench surface at a depth of 0 to 6 inches.

The systematic and biased soil samples will be containerized, labeled, and shipped to the laboratory, as described in **Worksheets #21, #26, and #27**.

Phase 2 Trench Unit

Radiological investigations will be conducted at the remaining 46 TUs in Parcel B associated with former sanitary sewer and storm drain lines (**Figure 3-1** and **Worksheet #18**). Investigations of the Phase 2 TUs will consist of a combination of gamma scan surveys and soil samples.

Each Phase 2 TU will undergo a 100 percent radiological surface gamma scan of accessible areas using an appropriate instrument. Elevated areas will be noted on a

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survey map and flagged in the field for verification.

Manual scans may be performed to further delineate suspect areas in the TU. Biased samples will be collected from potential areas of elevated activity as described in the Parcel B Work Plan.

Within the backfill of each previous TU boundary, VSP software (or equivalent) will be used to determine the location of the systematic soil boring locations. Each location will be cored down to approximately 6 inches below the depth of previous excavation. Each retrieved core will be gamma scan-surveyed along the entire length of the core in accordance with the WP. Scan measurement results of the retrieved core will be evaluated to investigate the potential for small areas of elevated activity in the fill material. A sample will be collected from the top 6 inches of material, and a second sample will be collected from the 6 inches of material just below the previous excavation depth. A third sample will be collected from the core segment between the first two samples with the highest gamma scan reading. At least three samples will be collected from each of the 18 borings, for a total of 54 samples within each previous TU boundary. The anticipated number of subsurface soil samples is shown in Worksheet #18; however, additional locations or samples may be required based on the evaluation following analysis of RBA data.

In addition, systematic cores will be placed every 50 linear feet on each trench sidewall to collect samples from locations representative of the trench sidewalls. The systematic boring locations will be located approximately 6 inches outside of the previous sidewall excavation limits and will extend 6 inches past the maximum previous excavation depth on both sidewalls in every trench. In the same fashion described in the previous paragraph, core sections will be retrieved, gamma scanned in accordance with the WP, and sampled such that at least three samples will be collected from each of the boring locations.

An example graphic showing the systematic sample locations and the sample locations representing the TU sidewalls is provided on **Figure 3-4**. Systematic soil samples will be located using VSP software (or equivalent). Each TU will be mapped in VSP, such that at a minimum, 18 systematic soil samples will be collected in each TU. The systematic soil samples will be plotted using a random start triangular grid using the VSP software with GPS coordinates for each systematic sample. The systematic and biased soil samples will be containerized and submitted to the offsite laboratory with appropriate chain-of-custody documentation as described in **Worksheets #21, #26, and #27.**

Surface Soil Survey Units

Radiological investigations will be conducted at the 15 SUs associated with soil from Buildings 103 and former Buildings 114, 142, and 157 where gamma scanning and

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sampling were previously conducted (**Figure 3-3** and **Worksheet #18**). Investigation of the current and former building site SUs will be performed in a similar fashion as the RSY process, using a combination of surface soil gamma scan surveys and systematic and biased surface soil sampling.

Each SU will undergo a 100 percent surface gamma scan of accessible areas using an appropriate instrument as described in the Parcel B Work Plan. The instrument will be composed of a gamma scintillation detector equipped with spectroscopy coupled to a data logger that logs the resultant data in conjunction with location. Gross gamma and gamma spectra obtained during the surface gamma scan surveys will be analyzed using region of interest peak identification tools for the ROCs (**Table 17-1**). Elevated areas will be noted on a survey map and flagged in the field for verification. Manual scans using a hand-held instrument may be performed to further delineate suspect areas in the SU. Biased samples will be collected from potential areas of elevated activity displaying gamma scan survey results as described in the Parcel B Work Plan.

Following the completion of the gamma scan surveys, systematic soil samples will be located using VSP software (or equivalent). Each SU will be mapped in VSP, such that at a minimum, 18 systematic soil samples will be collected in each SU. The systematic soil samples will be plotted using a random start triangular grid using the VSP software (or equivalent) with GPS coordinates for each systematic sample. An example graphic showing the sample locations is provided on **Figure 3-3**. The systematic and biased soil samples will be containerized and submitted to offsite laboratory with appropriate chain-of-custody documentation as described in **Worksheets #21, #26, and #27**.

17.2 Determination of Equilibrium Status

The RBA data set for ^{226}Ra and other naturally occurring ROCs will be selected to represent as much of the soil at HPNS as practical. However, the history of HPNS shows that a wide variety of fill materials have been were used as part of construction and maintenance activities over the life of the site. These fill materials may have a range of naturally occurring radioactivity, so an incorrect identification of fill material could result in higher levels of NORM being identified as contamination. To avoid this situation, additional evaluation may be performed for samples in which the ^{226}Ra gamma spectroscopy result exceeds the RG and the expected range of background, but the sample could still indicate association with NORM instead of contamination.

The uranium natural decay series is one of the primordial natural decay series collectively referred to as NORM. The members of the uranium natural decay series are present in background at concentrations that are approximately equal, a situation referred to as secular equilibrium. Secular equilibrium for the uranium natural decay series is established over hundreds of thousands of years. Concentrations of ^{226}Ra higher than the concentrations of other members of the uranium natural decay series may indicate contamination, while ^{226}Ra concentrations consistent with other members

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of the series indicate natural background.

Determining the equilibrium status of the uranium natural decay series requires analyzing a sample for multiple radionuclides from the series using the same or comparable analytical techniques. Observed differences in concentrations result primarily from differences in concentrations, and the uncertainty is primarily associated with the analysis.

Radionuclides from the uranium natural decay series with ^{226}Ra as a decay product (i.e., ^{238}U, ^{234}U, and ^{230}Th) will be analyzed by alpha spectroscopy, along with ^{226}Ra. It is not necessary to analyze for the decay products of ^{226}Ra because these radionuclides re-establish secular equilibrium with ^{226}Ra over a period of several weeks. In addition, most of the ^{226}Ra decay products are not readily analyzed by alpha spectroscopy.

If practical, the analyses will be performed using the same sample aliquot to reduce sampling uncertainty. The analytical results of the four radionuclides will be compared and evaluated in accordance with **Worksheet #11**.

17.3 Building Investigation

This section describes the design of radiological investigations, including scan and static measurements on building surfaces. The radiological investigation design and rationale is based on methods, techniques, and instrument systems in the Basewide Radiological Management Plan (TtEC, 2012), with the ultimate requirement being to demonstrate compliance with the Parcel B ROD RAO (Navy, 2009). For Building 140, the radiological investigation design is consistent with the *Technical Memorandum to Support Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping* (TtEC, 2011), as modified by Gilbane's technical proposal accepted by the Navy, dated August 22, 2018, with the ultimate requirement to demonstrate compliance with the Parcel B ROD RAO. The ROCs for the building investigation are listed in **Table 17-2**.

Table 17-2. Building Radionuclides of Concern

Building	ROCs	Reference
Building 103	^{90}Sr, ^{137}Cs, ^{239}Pu	NAVSEA, 2004
Building 113	^{90}Sr, ^{137}Cs, ^{239}Pu	NAVSEA, 2004
Building 113A	^{137}Cs, ^{226}Ra,	NAVSEA, 2004
Building 130	^{137}Cs, ^{226}Ra,	NAVSEA, 2004
Building 140	^{90}Sr, ^{137}Cs, ^{226}Ra, ^{239}Pu	NAVSEA, 2004
Building 146	^{90}Sr, ^{137}Cs, ^{226}Ra	NAVSEA, 2004

Radiological investigations will be conducted on impacted buildings to evaluate whether site conditions are compliant with the RAO in the Parcel B ROD (Navy, 2009). The RAO is to prevent receptor exposure to ROCs in concentrations that exceed RGs for all

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potentially complete exposure pathways. These RGs for structures, equipment, and waste are presented in **Table 17-3** for each of the ROCs identified for the applicable buildings. Also identified for each ROC is the primary particle type emitted during the ROC's decay, or the ROC's radioactive progeny's decay.

Table 17-3. Building Remediation Goals from Parcel B ROD

ROC	Particle Emissions	RGsfor Structures (dpm/100 cm^2)	RGs for Equipment, Waste (dpm/100 cm^2)
^{137}Cs	β	5,000	5,000
^{239}Pu	α	100	100
^{226}Ra	α, β	100	100
^{90}Sr	β	1,000	1,000

dpm/100 cm^2 = disintegration(s) per minute per 100 square centimeters

Data collected from building surfaces during this investigation represent the total (fixed and removable) gross activity on the surface, which may result from radiations from multiple radionuclides. Because these survey data are radiation-specific (α and β) but not radionuclide-specific, they cannot be attributed to a particular ROC. Instead, the survey data will be compared to the most restrictive building-specific RG_α and RG_β as presented in **Table 17-4**. For each building, the RG_α is chosen as the structure's lowest RG for an alpha-emitting ROC and the RG_β is chosen as the structure's lowest RG for a beta-emitting ROC.

Table 17-4. Building-specific Remediation Goals for Parcel B Work Plan

Building	RG_α (dpm/100 cm^2) and ROC	RG_β(dpm/100 cm^2) and ROC
Building 103	100 (^{239}Pu)	1,000 (^{90}Sr)
Building 113	100 (^{239}Pu)	1,000 (^{90}Sr)
Building 113A	100 (^{226}Ra)	5,000 (^{137}Cs)
Building 130	100 (^{226}Ra)	5,000 (^{137}Cs)
Building 140	100 (^{226}Ra/^{239}Pu)	1,000 (^{90}Sr)
Building 146	100 (^{226}Ra)	1,000 (^{90}Sr)

Parcel B Buildings will be divided into identifiable SUs similar in area and nomenclature to the previous investigation of each building. Generally, impacted floor surfaces and the lower 2 meters of remaining impacted wall surfaces will form Class 1 SUs of no more than 100 m2 each. The remaining impacted upper wall surfaces and ceilings will generally form Class 2 SUs of no more than 2,000 m^2 each. There are no Class 3 SUs. Additional information, including SU classifications, is provided in the Parcel B Work

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Plan. Alpha-beta scan, systematic alpha-beta static and swipe measurements, and biased alpha-beta static and swipe measurements where necessary will be collected from each SU. Building material samples will be collected if necessary.

SUs will be scanned to detect alpha and beta emitters using average scan rates that ensure an alpha probability of detection of approximately 90 percent where feasible, and that the beta scan MDC is less than or equal to the RG_{β} for the building (**Table 17-4**). Scanning will cover a total area of each SU according to its classification. The total surface area of remaining, accessible impacted surfaces to be scanned will be 100 percent in Class 1 SUs, and 50 percent in Class 2 SUs. SU scan lanes and static measurement locations will be marked using a consistent reference coordinate system throughout the building. In the absence of other technologies, locations will reference from the southernmost and westernmost points in the SU.

A minimum of 18 alpha-beta static measurements will be taken in each SU. The Parcel B Work Plan provides a number of samples calculations, and the18 static measurements are recommended as a placeholder until background data become available. The minimum number of static measurements per SU will be developed based on the variability observed in the RBA data. The data quality assessment (DQA) of SU data will include a retrospective power curve (based on the MARSSIM Appendix I guidance) to demonstrate that enough static measurements were performed to meet the project objectives. If necessary, additional static measurements may be performed to comply with the project objectives. Biased static measurements will be used to further investigate areas with potential elevated surface activity as described in the Parcel B Work Plan.

Swipe samples will be taken at all locations of systematic and biased static measurements. They will be taken dry, using moderate pressure, over an area of approximately 100 cm^2. Swipe samples will be measured for gross alpha and beta activity using instrumentation described in the Parcel B Work Plan. Swipe samples may be sent offsite if detectable activity exceeds criteria for removable contamination and does not appear to be attributable to radon progeny. Material samples may be collected to further characterize surface materials if static measurements exceed RGs. The surface activity on the sample will be compared to the total surface activity measured by the static measurement to assess the removable fraction of surface activity. This information may be used in any dose or risk assessment performed. Building material samples may be collected for offsite analysis to further characterize areas of interest. Remediation will be conducted in building areas with activity that exceed RGs or background, whichever is higher as described in **Worksheet #14** and the Parcel B Work Plan.

Background measurements will be obtained in the building RBAs for each instrument and on each surface type (e.g., concrete, wood, and sheet rock) that is also present in

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the SUs. Contiguous static measurements will be taken on each surface material in the RBA that is representative of the material in the building SUs. The mean instrument- and surface-specific background count rates will be used to update the instrument detection calculations and static count times in the Parcel B Work Plan. Building 404 will serve as the primary RBA in the investigation of Parcel B Building 140 (**Figure 4-2**). Building 404 is a non-impacted, unoccupied former supply storehouse constructed in 1943 (NAVSEA, 2004). Alternate RBAs may be identified and used if needed based on site-specific conditions identified during the building investigations.

17.4 Import Backfill Material

Imported backfill material will be sampled and analyzed in accordance with the *Information Advisory Clean Import Fill Material* (DTSC, 2001) and **SAP Worksheets #14** and **#18**. The backfill acceptance criteria for this project presented in **Worksheets #15.6** through **#15.14**.

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3,5]	Sampling SOP Reference
Phase 1 Trench Unit						
Phase 1 TU 004	HPPB-**CCC**-004A-DDD	Soil	Excavated material representing the sidewalls and bottoms of TU (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	72	See **Worksheet #21**
Phase 1 TU 013	HPPB-**CCC**-013A-DDD				54	
Phase 1 TU 021	HPPB-**CCC**-021A-DDD				144	
Phase 1 TU 023	HPPB-**CCC**-023A-DDD				144	
Phase 1 TU 026	HPPB-**CCC**-026A-DDD				108	
Phase 1 TU 033	HPPB-**CCC**-033A-DDD				126	
Phase 1 TU 036	HPPB-**CCC**-036A-DDD				90	
Phase 1 TU 039	HPPB-**CCC**-039A-DDD				108	
Phase 1 TU 045	HPPB-**CCC**-045A-DDD				90	
Phase 1 TU 047	HPPB-**CCC**-047A-DDD				108	
Phase 1 TU 048	HPPB-**CCC**-048A-DDD				36	
Phase 1 TU 049	HPPB-**CCC**-049A-DDD				162	
Phase 1 TU 050	HPPB-**CCC**-050A-DDD				234	
Phase 1 TU 050A	HPPB-**CCC**-050AA-DDD				234	
Phase 1 TU 051	HPPB-**CCC**-051A-DDD				216	
Phase 1 TU 054	HPPB-**CCC**-054A-DDD				216	
Phase 1 TU 056	HPPB-**CCC**-056A-DDD				216	
Phase 1 TU 057	HPPB-**CCC**-057A-DDD				162	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Phase 1 TU 059	HPPB-**CCC**-059A-DDD	Soil	Excavated material representing the sidewalls and bottoms of TU (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	108	See **Worksheet #21**
Phase 1 TU 065	HPPB-**CCC**-065A-DDD				144	
Phase 1 TU 130	HPPB-**CCC**-130A-DDD				36	
Phase 1 TU 131	HPPB-**CCC**-131A-DDD				36	
Phase 1 TU 132	HPPB-**CCC**-132A-DDD				36	
Phase 1 TU 186	HPPB-**CCC**-186A-DDD				54	
Phase 2 Trench Units						
Phase 2 TU 001	HPPB-**CCC**-001-**EEFF-GG-DDD**	Soil	Backfill of the excavation limits of former TUs (depth varies depending on historical excavated depth); Within 1 meter of the previous sidewall excavation limits of former TUs every 50 linear feet (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	54	See **Worksheet #21**
Phase 2 TU 002	HPPB-**CCC**-002-**EEFF-GG-DDD**				54	
Phase 2 TU 003	HPPB-**CCC**-003-**EEFF-GG-DDD**				54	
Phase 2 TU 005	HPPB-CCC-005-EEFF-GG-DDD				54	
Phase 2 TU 006	HPPB-CCC-006-EEFF-GG-DDD				54	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Phase 2 TU 007	HPPB-**CCC**-007-**EEFF**-**GG**-**DDD**	Soil	Backfill of the excavation limits of former TUs (depth varies depending on historical excavated depth); Within 1 meter of the previous sidewall excavation limits of former TUs every 50 linear feet (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	54	See **Worksheet #21**
Phase 2 TU 008	HPPB-**CCC**-008-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 009	HPPB-**CCC**-009-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 010	HPPB-**CCC**-010-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 011	HPPB-**CCC**-011-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 012	HPPB-**CCC**-012-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 014	HPPB-**CCC**-014-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 015	HPPB-**CCC**-015-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 016	HPPB-**CCC**-016-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 017	HPPB-**CCC**-017-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 018	HPPB-**CCC**-018-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 019	HPPB-**CCC**-019-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 020	HPPB-**CCC**-020-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 022	HPPB-**CCC**-022-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 024	HPPB-**CCC**-024-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 025	HPPB-**CCC**-025-**EEFF**-**GG**-**DDD**				54	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Phase 2 TU 027	HPPB-**CCC**-027-**EEFF**-**GG**-**DDD**	Soil	Backfill of the excavation limits of former TUs (depth varies depending on historical excavated depth); Within 1 meter of the previous sidewall excavation limits of former TUs every 50 linear feet (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	54	See **Worksheet #21**
Phase 2 TU 028	HPPB-**CCC**-028-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 029	HPPB-**CCC**-029-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 030	HPPB-**CCC**-030-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 037	HPPB-**CCC**-037-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 040	HPPB-**CCC**-040-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 041	HPPB-**CCC**-041-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 042	HPPB-**CCC**-042-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 043	HPPB-**CCC**-043-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 044	HPPB-**CCC**-044-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 046	HPPB-**CCC**-046-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 051A	HPPB-**CCC**-051A-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 052	HPPB-**CCC**-052-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 053	HPPB-**CCC**-053-**EEFF**-**GG**-**DDD**				54	
Phase 2 TU 055	HPPB-**CCC**-055-**EEFF**-**GG**-**DDD**				54	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Phase 2 TU 058	HPPB-**CCC**-058-**EEFF-GG-DDD**	Soil	Backfill of the excavation limits of former TUs (depth varies depending on historical excavated depth); Within 1 meter of the previous sidewall excavation limits of former TUs every 50 linear feet (depth varies depending on historical excavated depth)	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	54	See **Worksheet #21**
Phase 2 TU 060	HPPB-**CCC**-060-**EEFF-GG-DDD**				54	
Phase 2 TU 061	HPPB-**CCC**-061-**EEFF-GG-DDD**				54	
Phase 2 TU 062	HPPB-**CCC**-062-**EEFF-GG-DDD**				54	
Phase 2 TU 063	HPPB-**CCC**-063-**EEFF-GG-DDD**				54	
Phase 2 TU 064	HPPB-**CCC**-064-**EEFF-GG-DDD**				54	
Phase 2 TU 125	HPPB-**CCC**-125-**EEFF-GG-DDD**				54	
Phase 2 TU 126	HPPB-**CCC**-126-**EEFF-GG-DDD**				54	
Phase 2 TU 127	HPPB-**CCC**-127-**EEFF-GG-DDD**				54	
Phase 2 TU 128	HPPB-**CCC**-128-**EEFF-GG-DDD**				54	
Former Building Site and Existing Building Surface Soil Survey Units						
Phase 1 Building 103 SU A	HPPB-103-SUA-**DDD**	Soil	0-0.5	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	18	See **Worksheet #21**
Phase 1 Building 103 SU B	HPPB-103-SUB-**DDD**				18	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth[2] (feet bgs)	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Phase 1 Building 103 SU C	HPPB-103-SUC-**DDD**	Soil	0-0.5	Refer to **Worksheets #15.1, #15.2, #15.3, and #15.4**	18	See **Worksheet #21**
Phase 1 Building 103 SU D	HPPB-103-SUD-**DDD**				18	
Phase 1 Building 103 SU E	HPPB-103-SUE-**DDD**				18	
Phase 1 Building 103 SU F	HPPB-103-SUF-**DDD**				18	
Phase 1 Building 103 SU G	HPPB-103-SUG-**DDD**				18	
Phase 1 Building 157 SU 5	HPPB-157-SU5-**DDD**				18	
Phase 1 Building 157 SU 6	HPPB-157-SU6-**DDD**				18	
Phase 1 Building 157 SU 7	HPPB-157-SU7-**DDD**				18	
Phase 2 Building 114 SU 1	HPPB-114-SU01-**DDD**				18	
Phase 2 Building 114 SU 2	HPPB-114-SU02-**DDD**				18	
Phase 2 Building 142 SU 1	HPPB-142-SU01-**DDD**				18	
Phase 2 Building 142 SU 2	HPPB-142-SU02-**DDD**				18	
Phase 2 Building 142 SU 3	HPPB-142-SU03-**DDD**				18	
Phase 2 Building 157 SU 5	HPPB-157-SU5-**DDD**				18	
Phase 2 Building 157 SU 7	HPPB-157-SU7-**DDD**				18	

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Sampling ID Number[1]	Matrix	Depth (feet bgs)[2]	Analytical Group	Number of Samples[3]	Sampling SOP Reference
Building Investigations						
Interior Building Surfaces, as needed[4]	TBD	TBD	NA	Refer to **Worksheets #15.1**, **#15.2**, and **#15.3**	TBD	See **Worksheet #21**
Flooded pump pit (water or sediment)	TBD	TBD	TBD	Refer to **Worksheets #15.1**, **#15.2**, **#15.3, #15.15, #15.16,** and **#15.17**	TBD	
Discharge piping (water or sediment)	TBD	TBD	TBD	Refer to **Worksheets #15.1**, **#15.2**, **#15.3, #15.15, #15.16,** and **#15.17**	TBD	

Notes:

[1]The starting ID for each TU or SU is provided. The site IDs, locations and number of samples collected per site/location are presented in **Worksheets #17** and **#20**. Sample ID instructions are as follows:

Sample IDs from the Phase 1 soil TU investigation will use the following format: AABB-CCC-NNNA-DDD, where AA = facility; BB = site location; CCC = sample type; NNN = former trench unit number; A = alpha-numeric digit of each "batch" (beginning with A, in sequential order, followed by B, C, etc.), DDD = numeric sample digit (beginning with 001, in sequential order, followed by 002, 003, etc.).

Sample IDs from the Phase 2 soil TU investigation will use the following format: AABB-CCC-NNN-EEFF-GG-DDD where AA = facility; BB = site location; CCC = sample type; NNN = former trench unit number; EEFF = two-digit sample interval in feet bgs (EE feet = top of sample interval / FF feet = bottom of sample interval); GG = soil boring number within the TU (beginning with 01, in sequential order); DDD = numeric sample digit (beginning with 001, in sequential order). Note that EE and FF are whole numbers such that a value of "01" represents "1 foot bgs." Also note that surface samples (samples collected from the 0.0- to 0.5-foot depth interval) will be designated as 000H; H for half foot. If the surface sample is collected from a depth other than a half foot, the H designation will still be used; however, a note will be included in the field notes to indicate the actual depth sampled).

Sample IDs from the Former Building Site and Existing Building Surface Soil Survey Unit investigation will use the following format: AABB-CCCC-SUNN-DDDA, where AA = facility, BB = site location; CCCC = Building Site name; SUNN = survey unit number; DDD = numeric digit (beginning with 001, in sequential order, followed by 002, 003, etc.).

[2]Example depths have been provided for corresponding sample ID. Depths of samples and ID are provided in **Worksheet #14**.

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

[3]These values represent the minimum number of primary sample locations Additional biased samples may be collected.
[4]To further characterize site conditions, interior survey measurements may be supplemented by the collection of building material samples or the offsite analysis of swipe samples.
[5] Field QC requirements are found on **Worksheet #20**.
bgs = below ground surface

SAP Worksheet #19 – Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method // SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	Radiological (gamma spectroscopy)	USEPA 901.1Mod //ARS-007	Gallon size resealable plastic bag or equivalent container	~ 1000 grams (g)	None	None
Soil	Radiological (GFPC)	USEPA 905.0 Modified//ARS-032				
Soil	Radiological (alpha spectroscopy)	HASL 300 Pu-02-RC & SE-03 (modified to use Eichrom Ion Exchange Columns) // Analytical - ARS-026 Prep – ARS-036				
Soil	Radiological (Radon emanation)	USEPA 903.1 Mod // ARS-009				
Soil	VOCs	USEPA 5035A/8260B // Analytical and Prep – ARS-159	3 X 5-g TerraCore™ Samplers[4,5,7] or equivalent	5 g	<6°C	14 days
Soil	PAHs	USEPA 3541/8270SIM // EMAX-8270SIM	1 X 8- ounce (oz) Jar	30 g	<6°C	14 days/40 days
Soil	SVOCs	USEPA 3550C/8270D // Analytical – ARS-160 Prep – ARS-156	1 X 8-oz Jar	30 g	<6°C	14 days/40 days
Soil	PCBs	USEPA 3550C/8082A // Analytical – ARS-157 Prep – ARS-156	1 X 8-oz Jar	30 g	<6°C	None

SAP Worksheet #19 – Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method // SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements[2] (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	Pesticide	USEPA 3541/8081B// EMAX-8081	1 X 8-oz Jar	30 g	<6°C	14 days/40 days
Soil	TPH-GRO	USEPA 5035/8015M //EMAX-8015G	3 X 5-g TerraCore™ Samplers[4,5,8] or equivalent	5 g	<6°C	14 days
Soil	TPH-DRO, MO	USEPA 3541/8015M // EMAX-8015D	1 X 8-oz Jar	30 g	<6°C	14 days/40 days
Soil	Metals	USEPA 3050B/6020B // Analytical ARS-155 Prep – ARS-154	1 X 4-oz Jar	2 g	None	180 days[3]
Soil	Metals	USEPA 3050B/6010D // ARS-166	1 X 4-oz Jar	2 g	None	180 days[3]
Soil	Mercury	USEPA 7471B//ARS-152	1 X 4-oz Jar	2 g	<6°C	28 days[3]
Soil	Percent Moisture	ASTM D2216//ARS-162	1 X 4-oz Jar[6]	20 g	<6°C	10 days
Soil	Asbestos	EPA 600/R-93/116 //SOP-109	1 X 8-oz Jar	8 oz.	None	Not Applicable
Soil	pH	EPA 9045D // ARS-146	1 X 4-oz Jar	10 g	<6°C	None, however samples must be analyzed as quickly as possible after receipt.

Notes:

[1] Minimum sample volume or mass requirement if different from the container volume.

[2]Temperature compliance will be measured using temperature blanks included in the coolers used to ship the samples to the laboratory.

[3] The time listed is the maximum holding time for the analysis. Preparation time is included in the analytical method holding time.

SAP Worksheet #19 – Analytical SOP Requirements Table

Notes (Continued):

[4] If TerraCore samplers cannot be used due to saturated soil, then only the 8-ounce jar (which will be filled without headspace) will be used, and VOC analysis will be conducted from the jar sample.

[5]TerraCore samples will be immediately transferred to suitable vials for transportation to laboratory per SOP PR-TC-02.02.01.05.

[6]Percent moisture will only be collected in a separate container when samples are to be analyzed for VOCs or TPH-GRO only.

[7]Terracore kits for VOCs will consist of two unpreserved and one methanol-preserved vial because acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2-chloroethylvinyl ether (SOP PR-TC-02.02.01.05).

[8]Terracore kits for samples to be analyzed for TPH-GRO only will consist of two bisulfate vials and one methanol vial.

oz. = ounce/ounces

SAP Worksheet #20 – Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks[1]	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Phase 1 TU[2]									
Soil	Radiological (gamma spectroscopy)	2934	~~10%~~NA	NA	NA	None	NA	NA	3228
	Radiological (alpha spectroscopy)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[3,4]
	^{226}Ra (radon emanation)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[4]
	^{90}Sr (GFPC)	294	NA~~10%~~	NA	NA	None	NA	NA	324
Phase 2 TU[2]									
Soil	Radiological (gamma spectroscopy)	2484	NA~~10%~~	NA	NA	None	NA	NA	2733
	Radiological (alpha spectroscopy)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[3,4]
	^{226}Ra (radon emanation)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[4]
	^{90}Sr (GFPC)	249	NA~~10%~~	NA	NA	None	NA	NA	274
Former and Current Building Soil Survey Unit[2]									
Soil	Radiological (gamma spectroscopy)	306	NA~~10%~~	NA	NA	None	NA	NA	337
	Radiological (alpha spectroscopy)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[3,4]
	^{226}Ra (radon emanation)	TBD	NA~~10%~~	5%	NA	None	NA	NA	TBD[4]
	^{90}Sr (GFPC)	31	NA~~10%~~	NA	NA	None	NA	NA	35

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SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks[1,9]	No. of VOA Trip Blanks	No. of PT Sample	Total No. of Samples to Lab
Building Investigation									
TBD	Alpha-Beta static	18 per SU	TBD[5]	NA	NA	NA	NA	NA	TBD[6]
	Radiological (gamma spectroscopy)	TBD	NA	NA	NA	NA	NA	NA	TBD[7]
	Radiological (alpha spectroscopy)	TBD	NA	NA	NA	NA	NA	NA	TBD[7]
Import Material									
Soil	Radiological (gamma spectroscopy)	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	^{90}Sr (GFPC)	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	VOCs	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	SVOCs & PAHs	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	PCBs & Pesticides	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	TPH-GRO	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	TPH-DRO	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	Metals	TBD	NA10%	5%	NA	None[9]	NA	NA	TBD[8]
	pH	TBD	NA10%	NA	NA	None[9]	NA	NA	TBD[8]
	Asbestos	TBD	NA10%	NA	NA	None[9]	NA	NA	TBD[8]

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Notes:
[1]Equipment blanks for radiological data are not collected. Prior to chemical decontamination, equipment that comes in contact with samples will be dry wiped. The equipment will be radiologically cleared to confirm lack of radiological contamination in accordance with Appendix D *Radiation Protection Plan* of the WP. See **Worksheet #14**.
[2]The minimum number of sampling locations are provided. Additional biased samples may be collected.
[3]The number of samples will be based on the results of the gamma spectroscopy analysis for ^{137}Cs and GFPC analysis for ^{90}Sr, as described in **Worksheets #11** and **#17**.

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

[4]The number of samples will be based on the results of the gamma spectroscopy analysis for ^{226}Ra, as described in **Worksheets #11** and **#17**.

[5]QC of radiological survey measurements will be performed in accordance with the Radiation Protection Plan (Appendix C of the Parcel B Work Plan).

[6]The total number of measurements will be based on the number of SUs within each building. A minimum of 18 static measurements will be collected. Additional biased measurements may be performed.

[7] Samples of building materials, water, or sediment may be collected to further investigate areas of interest.

[8] The number of import backfill samples will be determined in the field based on the number and volume of import material sources sampled.

[9] None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment per **Worksheet # 12**; disposable equipment anticipated.

MS/MSD not applicable to radiological testing

TBD = to be determined

SAP Worksheet #21 – Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
PR-TC-01.04.04.00	Field Documentation	Gilbane	Logbook, Field Sheets, Indelible Pens	N	Attachment 2 of SAP
PR-TC-02.12.02.00	Sample Tracking and Electronic Data Management	Gilbane	Database	N	Attachment 2 of SAP
PR-TC-02.04.01.01	Sample Handling, Packaging and Shipping	Gilbane	Laboratory-supplied Coolers	N	Attachment 2 of SAP
PR-TC-04.01.00.00	Review, Verification, and Validation of Chemical Data	Gilbane	Not Applicable	N	Attachment 2 of SAP
PR-TC-02.02.01.05	Volatile Organic Compound (VOC) Sampling	Gilbane	Per EPA 5035	N	Attachment 2 of SAP
PR-TC-02.02.01.01	Surface Soil: Sampling with Trowel or Spoon	Gilbane	Disposable Scoop	N	Attachment 2 of SAP
PR-TC-02.02.01.02	Shallow Soil: Drive Sampler, Hand Auger or Test Pit	Gilbane	Hand Auger	N	Attachment 2 of SAP
PR.TC-02.02.01.03	Subsurface Soils: Direct-Push or Drill Rig	Gilbane	DPT Rig	N	Attachment 2 of SAP

SAP Worksheet #21 – Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
PR-TC-02.02.07.01	Waste Management: Sampling of Containerized Wastes (including Investigation-Derived Wastes)	Gilbane	Various	N	Attachment 2 of SAP

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Photoionization Detector (PID)	• Calibration Check • Daily cleaning during field use • Proper storage when not in use	Daily (prior to field use)	Per manufacturer specifications	Recalibrate instrument. If still out, return instrument.	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.
Global Positioning System (GPS)	• No calibration Required • Charge batteries • Clean of dust, dirt, and grease • Store instrument in case when not in use	Daily	± 10 mm horizontally and 15 mm vertically	If the instrument can not connect to satellites, then the secondary unit will be used to verify that there are no connections.	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed.

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Radiation Solutions Model RS-700 with detector RSI RSX-1 (or equivalent), Ludlum Model 2221 with detector model 44-20 (or equivalent); Ludlum Model 43-37-1 (or equivalent); Ludlum model 43-93 (or equivalent; Protean WPC 9550 or Ludlum Model 2929 (or equivalent)	Calibrate at lab utilizing National Institute of Standards and Technology traceable standards	Radiological controls portable instrument procedures are described in detail in Attachment C of the Parcel B Work Plan			Project RSO, RCTs	Radiological controls portable instrument procedures are described in detail in Attachment C of the Parcel B Work Plan.	If equipment is deemed inoperable or is malfunctioning, it will be removed from use and replaced.
	Efficiency Check						
	Operational checks and verifications						
	Maintenance/Inspection						

Notes:
Additional instrumentation may be used as described in the Parcel B Work Plan

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
AAR-L-171	Rapid Determination of Ra-226 in Environmental Samples, Rev.0.1, Effective 11-12-19	Definitive	Soil/Radiochemical (alpha spectroscopy)	Alpha Spectroscopy	ARS	N
ARS-007	Modified Gamma Emitting Radionuclides in Soil, Air and Biota Matrices, Rev. 7.5, Effective 5/28/2020	Definitive	Soil/Radiochemical (gamma spectroscopy)	EG&G Ortec Gamma Spectrometer	ARS	N
ARS-009	Radium-226 in Drinking Water (Radon Emanation Technique) (USEPA 903.1 & 903.1 Mod), Rev. 6.5 Effective Date: 5/4/2020	Definitive	Soil/Radiochemical (radon emanation)	Scintillation Cell	ARS	N
ARS-032	Strontium 89, 90 and Total Strontium in Water, Soil and Vegetation Matrices by Eichrom Resin Separation (USEPA 905.0M) Rev. 8.5, Effective 6/1/2020	Definitive	Soil and Water /Radiochemical (GFPC)	Gas Flow Proportional Counting System	ARS	N
ARS-026	Am, Pu, and U Sequential Separation Using Eichrom Stabilized Chemistry Resin, Rev 15.2, Effective 1/25/2020	Definitive	Soil and Water /Radiochemical (alpha spectroscopy)	Alpha Spectroscopy	ARS	N

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ARS-031	Thorium in Water, Soil and Vegetation Matrices by Eichrom Resin Separation (ACW10), Revision 8.3, Effective 10/17/19	Definitive	Soil and Water /Radiochemical (alpha spectroscopy)	Alpha Spectroscopy	ARS	N
ARS-159	Volatile Organic Compounds by Purge and Trap GC/MS Revision 2.4, Effective 9/6/2019	Definitive	Soil /VOCs	Gas Chromatograph (GC)/Mass Spectrometer (MS)	ARS	N
EMAX-8015G	Gasoline Range Organics, Rev. 5, Reviewed 4/21/2020	Definitive	Soil/TPH as GRO	GC/FID	EMAX	N
EMAX-8015D	Diesel Range Organics, Rev. 7, Reviewed 7/8/2020	Definitive	Soil/TPH as DRO and MO	GC/FID	EMAX	N
ARS-160	SVOC Analysis by GC/MS Rev 2.4 Effective 9/26/2019	Definitive	Soil/SVOCs	GC/MS	ARS	N
EMAX-8270SIM	Semivolatile Organics by GC/MS, Rev. 2, Reviewed 7/2/2020	Definitive	Soil/PAHs	GC/MS	EMAX	N
ARS-157	Polychlorinated Biphenyls (PCBs) by Gas Chromatography/Electron Capture Detector (GC/ECD) Revision 3.3 Effective Date 11/18/2019	Definitive	Soil/PCBs	GC/ECD	ARS	N

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EMAX-8081	Organochlorine Pesticides by GC, Rev. 8, Reviewed 7/22/2020	Definitive	Soil/Water Pesticides	GC/ECD	EMAX	N
ARS-155	Trace Metals by ICP/MS Revision 2.4, Effective 9/13/19	Definitive	Soil/ ICP/MS Metals	ICP/MS	ARS	N
ARS-166	Metals by ICP-OES Rev. 1.5 Effective 10/21/2019	Definitive	Soil/ Water ICP-OES Metals	ICP-OES (Inductively coupled plasma - optical emission spectrometry)	ARS	N
ARS-152	Mercury by Cold-Vapor Atomic Absorption (CVAA) Revision 1.1, Effective 10/5/2020	Definitive	Soil/Mercury	Cold Vapor Atomic Absorption	ARS	N

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SOP 109	Asbestos Bulk Sample Analysis, PLM, Version 12, Effective: 9/17/2020	Definitive	Asbestos	Polarized Light Microscopy	A&B Labs	N
ARS-146	pH using a HACH SensION MM340 Meter Revision 1.5. Effective 10/28/2019	Definitive	pH	pH Meter	ARS	N

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Initial Calibration (ICAL) Energy, Efficiency and full width at half maximum (FWHM) peak resolution.	Prior to initial use, following repair or loss of control, and upon incorporation of new or changed instrument.	Verify manufacturer's specifications for gamma peak resolution. Efficiency vs energy for each geometry/matrix 95% confidence limit of the fitted function: ≤8% over energy range. Or Peak energy difference is within 0.1 keV of reference energy for all points. Peak FWHM <2.5 keV at 1,332 keV. Energy vs channel slope equation shall be linear and accurate to 0.5 keV.	Correct problem, repeat ICAL. No samples shall be run until all calibration criteria are met.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.5.6.2
Gamma Spectrometer	Initial Calibration Verification (ICV)	After initial calibration for energy and efficiency and before sample analysis	Observed peaks of second source standard fall within ±10% of initial calibration value relative to energy, FWHM, and efficiency.	Verify second source standard and repeat ICV to check for errors. If that fails, identify and correct the problem and repeat ICV.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.5.6.2

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Continuing Calibration Verification (CCV) (Daily Check)	Daily or before use. When working with long count times or batch sequences that run more than a day, CCV is performed at the beginning and end of each analytical batch as long as it is not longer than a week.	Response checks shall be control charted and have a tolerance limit set at ±3σ. Control charts shall be monitored for trending and evaluation of process shall be taken at ±2σ. Or Peak energy/efficiency: low, mid, and high energies within 10% of the initial calibration. FWHM: low, mid, and high energies within 10% of initial FWHM value.	Check control chart for trends. Determine cause, correct problem, and repeat CCV. If that fails then repeat ICAL. Reanalyze all associated samples since last successful CCV. If reanalysis cannot be performed, apply Q-flag to all results for the specific nuclide(s) in all samples since the last acceptable calibration verification.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.5.6.2
Gamma Spectrometer	Background Subtraction Count Measurement (BSC) (Long count for subtracting background from blanks or test sources)	Immediately after ICAL and then performed on at least a monthly basis (MARLAP 18.5.6,2)	Statistical Test of successive counts and count rates for identified background peaks show no significant difference Or Within ±3σ of mean activity of recent BSCs (minimum of 3 BSCs).	Check control cart for trends and recount. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze all impacted samples since last acceptable BSC. If reanalysis is not possible, apply B-flag to all results for specific nuclides in all samples associated with the failed BSC.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.5.6.2

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Flow Proportional Counter (GFPC)	Initial Calibration – Voltage Plateau (ICALV) (separate plateaus determined for alpha and beta activity)	Prior to initial use, after l loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications. Plot voltage vs. count rate to determine proper operating voltages. Or Slope of the plateau less than 5% over a range of 100 V.	Correct problem, repeat ICALV.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1
GFPC	Initial Calibration – Efficiency (ICALE)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for detector efficiency for both alpha and beta counting modes using electroplated sources. A 1σ counting uncertainty (CU) of ≤1% shall be achieved for all detector efficiency determinations.	Correct problem, repeat ICALE.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1
GFPC	Initial Calibration – Crosstalk Factors (ICALCT)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for cross talk in alpha and beta channels.	Correct problem, repeat ICALCT.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GFPC	Initial Calibration – Self-Absorption Curve (ICALSA)	Prior to initial use, after loss of control, and upon incorporations of new or changed instruments settings.	For each radionuclide of interest, establish mathematical function (curve) of detector efficiency vs. source mass loading. 95% confidence limit of the fitted function (curve) over the calibration range to ≤10% and ≤5% uncertainty for alpha and beta, respectively. Or Best fit of data with correlation coefficient closest to `.0 and the smallest standard error.	Correct problem, repeat ICALSA.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1
GFPC	Initial Efficiency Calibration Verification (IECV)	After ICALE for alpha and beta and before analysis of samples.	A tolerance limit or control chart shall be established immediately after the initial counting efficiency calibration and after instrument loss of control. Efficiencies shall be control charted and have a tolerance limit set at ± 3% or 3σ of the mean. Or Value of second source calibration for each isotope within ±10% of initial calibration value.	Verify second source - standard. Rerun IECV. If that fails, correct problem and repeat ICALE and IECV, as appropriate No samples shall be run until calibration has been verified.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GFPC	Continuing Calibration Verification (CCV)	After a counting gas change and daily for short test-source counting intervals. For longer test-source counting times, a detector response check for a multi-sample shelf unit shall be conducted before test source counting, while a detector response check for a sequential sample counter shall be performed before and after the sample batch.	Responses shall be control charted and have a tolerance limit set at ±3σ or 3% of the mean.	Check Control chart for trends. Determine cause, correct problem, rerun calibration verification. If that fails, repeat ICALE. Reanalyze all samples since the last successful calibration verification. .	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1
GFPC	Background Subtraction Count (BSC) Measurement (Long count for subtracting background from blanks or test sources)	Determine alpha and beta background initially and after efficiency calibration. Performed at least on a monthly basis.	Use a statistical test to determine a change in the background count rate value. Or Within ± 3σ of mean activity of recent BSCs (minimum of 3 BSCs).	Reanalyze samples associated with failed BSC if possible, otherwise qualify.	Count-room Specialist	DoD/DOE QSM, Version 5.3, MARLAP 18.5.6.1 & 18.5.6.4

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer	Initial Calibration (Energy, efficiency and FWHM peak resolution)	Prior to initial use, following repair or loss of control, and upon incorporation of new or changed instrument	Verify manufacturer's specifications for point source efficiency; and At least three isotopes within the energy range of 3 to 6 MeV Energy vs Channel Slope equation <15 keV per channel. Full Width – Half Maximum (FWHM) ≤ 100 keV for each peak used for calibration Minimum of 3,000 net counts in each peak	No samples may be run until energy and FWHM calibration criteria are met. Correct problem, repeat ICAL	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.2.6.3
Alpha Spectrometer	Initial Calibration Verification (ICV)	After initial calibration	Determine peak location, resolution, and region of interest/alpha peak efficiency (where counting efficiency is an analytical requirement) using at least two alpha peaks. Or FWHM ≤100 keV and within ±20 keV of corresponding calibration peaks in initial energy calibration.	Repeat ICV to check for error. No samples may be run until calibration has been verified. If that fails, identify and correct problem and repeat ICV or ICAL and ICV as appropriate.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.2.6.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer	Continuing Calibration Verification (CCV) (Check source)	Weekly source check verification before analysis of samples	Energy response check shall be control charted and have a tolerance limit set at ±3σ. Control charts shall be monitored for trending and evaluation of process shall be taken at ±2σ. Or FWHM ≤100 keV and within 30 keV of corresponding calibration peaks in initial energy calibration	Check control chart for trends. Determine cause, correct problem, and repeat CCV. If that fails, repeat ICAL. Reanalyze all associated samples since last successful CCV. If reanalysis cannot be performed, apply Q-flag to all results for the specific nuclide(s) in all samples since the last acceptable calibration verification.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.2.6.3
Alpha Spectrometer	Background Subtraction Count Measurement (BSC)	Prior to initial use or after initial calibration and monthly thereafter.	Use a statistical test to determine a change in the background count rate value. Or Within ± 3σ of mean activity of recent BSCs for total ROI for all isotopes of interest (minimum of 3 BSC values).	Check control chart for trends and recount. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze all impacted samples since last acceptable BSC. If reanalysis cannot be performed, apply B-flag to all samples associated with the failed BSC.	Count-room Specialist	DoD/DOE QSM, Version 5.3 MARLAP 18.2.6.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of 4-Bromofluorobenzene (BFB) or decafluorotriphenylphosphine (DFTPP) from method.	Retune instrument and verify. No samples shall be analyzed without a valid tune.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS	Performance Check (Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol shall be present at their normal responses, and shall not exceed a tailing factor of 2.	Correct problem, then repeat performance checks. No samples shall be analyzed until performance check is within criteria	Analyst	DoD/DOE QSM, Version 5.3
GC/MS	Initial calibration (ICAL) – for all analytes (including surrogates)	At instrument set-up, after ICV or CCV failure, before sample analysis Minimum 5 levels for linear and 6 levels for quadratic.	Relative standard deviation (RSD) for each analyte ≤15%. Or Linear least squares regression for each analyte: $r^2 \geq 0.99$ Or Non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem, repeat ICAL. No samples shall be analyzed until ICAL has passed.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Evaluation of Relative Retention Times (RRT)	With each sample After maintenance is performed which may affect retention times, RRTs may be updated based on the daily CCV.	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then re-run ICAL.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS	Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard before sample analysis	All reported analytes within ±20% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS	Internal standards (IS)	Every field sample, standard and QC sample.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; extracted ion current profile area within – 50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Re-analysis of samples analyzed while system was malfunctioning is mandatory.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Continuing Calibration Verification (CCV)	Daily before sample analysis, after every 12 hours of analysis time, and at the end of the analytical batch run	All reported analytes and surrogates within ±20% of true value. All reported analytes and surrogates within ±50% for end of analytical batch CCV.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. Results may not be reported without valid CCVs. If reanalysis cannot be performed, lab will apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS (SIM)	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of DFTPP from method 8270. Tune can be acquired as full scan.	Retune instrument and verify. No samples shall be analyzed without a valid tune.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS (SIM)	Performance Check (Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. DDT breakdown and tailing factors are considered overall measures of port inertness and column performance and are required checks for SIM operation. Full scan acceptable for acquisition.	Correct problem, then repeat performance checks. No samples shall be analyzed until performance check is within criteria	Analyst	DoD/DOE QSM, Version 5.3
GC/MS (SIM)	Initial calibration (ICAL) – for all analytes (including surrogates)	At instrument set-up, after ICV or CCV failure, before sample analysis Minimum 5 levels for linear with one point at same concentration as CCV.	Relative standard deviation (RSD) for each analyte ≤20%. Or Linear least squares regression for each analyte: $r^2 \geq 0.99$	Correct the problem, repeat ICAL. No samples shall be analyzed until ICAL has passed.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS (SIM)	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS (SIM)	Evaluation of Relative Retention Times (RRT)	With each sample After maintenance is performed which may affect retention times, RRTs may be updated based on the daily CCV.	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then re-run ICAL.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS (SIM)	Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard before sample analysis	All reported analytes within ±20% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Analyst	DoD/DOE QSM, Version 5.3
GC/MS (SIM)	Internal standards (IS)	Every field sample, standard and QC sample. Internal Standard is spiked no greater than 0.40 ng/µL concentration. 1, 4-dichlorobenzene-d4 is ignored for SIM.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; extracted ion current profile area within – 50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Re-analysis of samples analyzed while system was malfunctioning is mandatory.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS (SIM)	Continuing Calibration Verification (CCV)	Daily before sample analysis, after every 12 hours of analysis time, and at the end of the analytical batch run	Concentration the same as the mid-point calibration standard (or lower). All reported analytes and surrogates within ±20% of true value. All reported analytes and surrogates within ±50% for end of analytical batch CCV.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. Results may not be reported without valid CCVs. If reanalysis cannot be performed, lab will apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	Breakdown check (Endrin/DDT) Method 8081 only	Before sample analysis and at the beginning of each 12-hour shift.	Degradation of DDT and Endrin must each be ≤ 15%.	Correct problem, then repeat breakdown checks. No samples shall be run until degradation of DDT and Endrin is each ≤ 15%.	Analyst	DoD/DOE QSM, Version 5.3
GC	Initial Calibration (ICAL) for all analytes (including surrogates)	At instrument set-up and after ICV or CCV failure, before sample analysis Must be performed using a 5-point calibration.	RSD for each analyte ≤20%. Or linear least squares regression for each analyte: r2 ≥ 0.99; or non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem, repeat ICAL. No samples shall be analyzed until ICAL has passed.	Analyst	DoD/DOE QSM, Version 5.3
GC	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	DoD/DOE QSM, Version 5.3
GC	Retention Time (RT) window width	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	Not Applicable	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within established RT windows. All reported analytes within ± 20% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Analyst	DoD/DOE QSM, Version 5.3
GC	Continuing Calibration Verification (CCV)	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence with the exception of CCVs for Pesticide multicomponent analytes (i.e., Toxaphene, Chlordane and Aroclors other than 1016 and 1260), which are only required before sample analysis.	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ± 20% of true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Or Recalibrate; reanalyze all affected samples since the last acceptable CCV. Results may not be reported without valid CCVs. If reanalysis cannot be performed, the lab will apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/MS	Linear Dynamic Range (LDR) or High-level Check Standard	At initial set-up and checked every 6 months with a high standard at the upper limit of the range	Within ±10% of true value.	Dilute samples within the calibration range, or re-establish/verify the LDR.	Analyst	DoD/DOE QSM, Version 5.3
ICP/MS	Tuning	Prior to ICAL	Mass calibration ≤ 0.1 atomic mass units (amu) from the true value; Resolution < 0.9 amu full width at 10% peak height.	Retune instrument and verify.	Analyst	DoD/DOE QSM, Version 5.3
ICP/MS	Initial Calibration (ICAL) for all analytes	Daily ICAL before sample analysis	If more than one calibration standard is used, r^2 ≥0.99.	Correct problem, repeat ICAL.	Analyst	DoD/DOE QSM, Version 5.3
ICP/MS	Initial Calibration Verification (ICV)	Once after each ICAL analysis of a second source standard before sample analysis	All reported analytes within ±10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/MS	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All reported analytes within ±10% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective actions(s) and recalibrate; reanalyze all affected samples since the last acceptable CCV. Or Recalibrate, and reanalyze all affected samples since the last acceptable CCV	Analyst	DoD/DOE QSM, Version 5.3
ICP/MS	Low-level Calibration Check Standard (LLICV)	Daily	All reported analytes within ±20% of the true value.	Correct problem and repeat ICAL.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/MS	Internal Standards (IS)	Every field sample, standard and QC sample.	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL blank.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Re-analyze sample at 5-fold dilutions until criteria are met. For failed QC samples, correct problem, and rerun all associated failed field samples.	Analyst	DoD/DOE QSM, Version 5.3
ICP/MS	Initial and Continuing Calibration Blank (ICB/CCB)	Immediately after the ICV and immediately after every CCV	The absolute values of all analytes must be <1/2 LOQ or 1/10th the amount measured in any sample.	ICB: Correct problem and repeat ICV/ICB. If that fails, rerun ICAL. All samples following the last acceptable calibration blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s).	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/MS	Interference Check Samples (ICS; also called Spectral Interference Checks)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOD (unless they are a verified trace impurity from one of the spiked analytes). ICS-AB: Within ±20% of true value.	Terminate analysis, locate and correct problem, reanalyze ICS, and reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the failed ICS.	Analyst	DoD/DOE QSM, Version 5.3
ICP-OES	Linear Dynamic Range (LDR) or High-level Check Standard	At initial set-up and checked every 6 months with a high standard at the upper limit of the range	Within ±10% of true value.	Dilute samples within the calibration range, or re-establish/verify the LDR.	Analyst	DoD/DOE QSM, Version 5.3
ICP-OES	ICAL	Daily ICAL prior to sample analysis.	If more than one standard is used, $r^2 \geq 0.99$ Minimum one high standard and a calibration blank.	Correct problem, repeat ICAL. No samples shall be analyzed until ICAL has passed.	Analyst	DoD/DOE QSM, Version 5.3
ICP-OES	ICV	Once after each ICAL analysis of a second source standard before sample analysis	All reported analytes, within ±10% of true value	Correct problem. Rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-OES	CCV	After every 10 field samples and at the end of the analysis sequence	All reported analytes, within ±10% of true value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective actions(s) and recalibrate; reanalyze all affected samples since the last acceptable CCV. Or recalibrate, and reanalyze all affected samples since the last acceptable CCV.	Analyst	DoD/DOE QSM, Version 5.3
ICP-OES	Low-level Calibration Check Standard (LLCCV)	Daily.	All reported analytes within ± 20% of the true value. LLCCV should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.	No samples shall be analyzed without a valid Low-Level Calibration Check Standard (LLCCV).	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/OES	ICB/CCB	Immediately after the ICV and immediately after every CCV	The absolute values of all analytes must be <1/2 LOQ or 1/10th the amount measured in any sample.	ICB: Correct problem and repeat ICV/ICB. If that fails, rerun ICAL. All samples following the last acceptable calibration blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s).	Analyst	DoD/DOE QSM, Version 5.3
ICP-OES	ICS	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOD (unless they are a verified trace impurity from one of the spiked analytes). ICS-AB: Within ±20% of true value.	Terminate analysis, locate and correct problem, reanalyze ICS, and reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the failed ICS.	Analyst	DoD/DOE QSM, Version 5.3
Cold Vapor Atomic Absorption (CVAA)	Initial Calibration (ICAL) for all analytes	Daily ICAL before sample analysis CVAA/Mercury: minimum 5 standards and a Calibration Blank.	r^2 ≥0.99	Correct problem, repeat ICAL. No samples shall be analyzed until ICAL has passed.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Respon-sible for CA	SOP Reference
CVAA	ICV	Once after each ICAL analysis of a second source standard before sample analysis	All reported analytes, within ±10% of true value	Correct problem. Rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Analyst	DoD/DOE QSM, Version 5.3
CVAA	Low-level Continuing Calibration Verification (LLCCV) Standard	Daily.	All reported analytes within ± 20% of the true value. LLCCV should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.	No samples shall be analyzed without a valid Low-Level Calibration Check Standard (LLCCV).	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Respon -sible for CA	SOP Reference
CVAA	CCV	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective actions(s) and recalibrate; reanalyze all affected samples since the last acceptable CCV. Or Recalibrate, and reanalyze all affected samples since the last acceptable CCV. Results may not be reported without valid CCVs.	Analyst	DoD/DOE QSM, Version 5.3

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
CVAA	ICB/CCB	Immediately after the ICV and immediately after every CCV.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable Calibration Blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s). Results may not be reported without valid Calibration Blanks	Analyst	DoD/DOE QSM, Version 5.3
pH probe	pH measurement using 4 and 10 buffers	Daily Initial calibration prior to sample analysis	When calibration is complete the instrument will print out a calculated slope. This slope must be between –58 and –64 mV/pH to be valid.	If the slope is outside of the approved range, the probe must be recalibrated.	Analyst	ARS-146

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Respon -sible for CA	SOP Reference
PLM	a) The substage condenser and iris diaphragm are centered in the optic axis; b) Set microscope for Kohler illumination (when applicable); c) The substage analyzer and polarizer are oriented at 90 degrees to each other; d) The ocular crosshairs coincide with the privileged directions of the polarizer and analyzer; e) The objectives are centered to prevent any grains from leaving the field of view during stage rotation;	Daily before use	a) The substage condenser and iris diaphragm are centered in the optic axis; b) Set microscope for Kohler illumination (when applicable); c) The substage analyzer and polarizer are oriented at 90 degrees to each other; d) The ocular crosshairs coincide with the privileged directions of the polarizer and analyzer; e) The objectives are centered to prevent any grains from leaving the field of view during stage rotation;	Maintenance	PLM Supervis or	SOP 109; §6.1.1
PLM	Refractive index liquids must be calibrated with an accuracy of 0.004.	Monthly	+/- 0.004	Purchase new RI liquids	PLM Supervis or	SOP109; §6.1.2

Notes:
ICP = inductively coupled plasma spectrophotometer
PLM = polarized light microscopy
LOD = limit of detection
ICP/MS = inductively coupled plasma/mass spectrophotometer

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Respon-sible Person	SOP Reference
Gamma Spectrometer	1. Maintenance: Liquid Nitrogen Fill 2 Calibration Verification 3. Background • Long Background • Background Check	1. Minimum twice weekly 2. Daily 3. • Monthly • Daily	1. None 2. Within 3 sigma of measured population 3. Within 3 sigma of measured population	1. None 2. The instrument shall be tagged out of service and the cause of the failure shall be investigated. 3. The background is recounted. If it fails the second count, the instrument is tagged out for the day. Failure on successive days results in tag-out of the instrument and initiation of corrective action.	Count-room Speciali st	ARS-014 "Operational Quality Assurance," ARS-013 "Noncon-formance Reporting and Corrective Action," and ARS-044 "Segregation of Out-of-Tolerance Instruments"

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Respon -sible Person	SOP Reference
Gas Flow Proportional Counter	1. Efficiency Verification 2. Background • Long Background • Background Check	1. Daily 2. • 7-13 days • Daily	1. ±3sigma 2. The result is within 3 standard deviations of the mean of the 30 most recent measurements and The count rate measured is statistically consistent at the 3-sigma level with the most recent long background count results	1. The instrument or individual detectors shall be tagged out of service and the cause of the failure shall be investigated. 2. Sample analysis on the affected detector(s) is halted until a new long measurement indicates satisfactory performance. If the second measurement confirms that background count rate has changed, the instrument is tagged "Out of Service" and a determination is conducted to determine the cause. And Sample analysis on the affected detector will be halted until a repeat count indicates that the current count rate is equivalent to that of the long background.	Count Room Speciali st	ARS-014 "Operational Quality Assurance," ARS-013 "Noncon-formance Reporting and Corrective Action," and ARS-044 "Segregation of Out-of-Tolerance Instruments

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Respon-sible Person	SOP Reference
Alpha Spectrometer	1. Energy Calibration Verification 2. Counting Efficiency 3. Background • Long • Check	1. Daily 2. Daily 3. • Monthly • Weekly	1. ± 3 Sigma 2. ± 3 Sigma 3. ± 3 Sigma	Sample analysis on the affected detector(s) is halted until a new long measurement indicates satisfactory performance. If the second measurement confirms that background count rate has changed, the instrument is tagged "Out of Service" and a determination is conducted to determine the cause.	Count-room Speciali st	ARS-014 "Operational Quality Assurance," ARS-013 "Noncon-formance Reporting and Corrective Action," and ARS-044 "Segregation of Out-of-Tolerance Instruments
GC/MS (Volatile) GC/MS (Semivolatile) GC/ECD GC/FID ICPMS Cold Vapor AA	Physical Check of Parameter Setup	Initially; prior to daily calibration check	Predetermined optimum parameter settings	Reset if incorrect	Analyst	ARS-014 ARS-013 ARS-044 EMAX-8015D EMAX-8015G EMAX-8081 EMAX-8270SIM
GC/MS (Volatile) GC/MS (Semivolatile) ICPMS	Tune Check	Initially; prior to daily calibration check	Compliance to ion abundance criteria	Repeat tune check to rule out standard degradation or inaccurate injection. If problem persists, retune the instrument and repeat tune check.	Analyst	ARS-014 ARS-013 ARS-044 EMAX-8270SIM

SAP Worksheet #26 – Sample Handling System

SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team / Gilbane
Sample Packaging (Personnel/Organization): Field Team Lead / Gilbane
Coordination of Shipment (Personnel/Organization): Field Team Lead/ Gilbane
Type of Shipment/Carrier: Overnight shipping service /FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory receipt clerk /ARS, EMAX and A&B
Sample Custody and Storage (Personnel/Organization): Laboratory technician or custodian / ARS, EMAX and A&B
Sample Preparation (Personnel/Organization): Laboratory technician / ARS, EMAX and A&B
Sample Determinative Analysis (Personnel/Organization): Analyst / ARS, EMAX and A&B
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 calendar days
Sample Extract/Digestate Storage (Number of days from extraction/digestion): Up to 40 calendar days depending on method holding times
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian /ARS, EMAX, and A&B
Number of Days from Analysis: Any remaining sample volume will be returned under COC for archiving to: Gilbane Federal Attn: Kimberly Tom 200 Fisher Avenue Hunters Point Naval Shipyard San Francisco, CA 94124

SAP Worksheet #27 – Sample Custody Requirements Table

Soil Sample Identification Procedures

The former TUs will be excavated and characterized in "batches" that will be given new unique identifiers at the time of excavation. Excavated material representing the backfill material from former TUs and excavated material representing the sidewalls and bottoms of former TUs will be given a unique ID number that is carried through the entire process of sample collection to data reporting (see **Worksheet #18**).

Samples will be assigned an alpha-numeric identifier that will be tied to the sampling location and sampling depth through a planned sample table that will be maintained in the field by the field sampling personnel in conjunction with the project chemist. The field sampling personnel's field notes in accordance with Gilbane SOP PR-TC-1.04.04.00 (**Worksheet #21** and **Attachment 2**) will be kept in addition to the chain-of-custody.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Field sample custody procedures include sample collection, packaging, shipment, and delivery to the laboratory. Custody of field samples will be maintained and custody transfer will be documented from the time of sample collection through receipt of samples at the analytical laboratory using chain-of-custody and custody seal procedures. These requirements will be fulfilled by the Sample Coordinator or qualified designee. Samples are considered to be in a person's custody if the following occurs:

- The sample is in the person's physical possession
- The sample is in view of the person after that person has taken possession.
- The sample is secured so that no one can tamper with the sample.
- The sample is secured in an area that is restricted to authorized personnel.

Samples will be shipped directly from the field to each analytical laboratory. Samples will be packaged and shipped for offsite analysis in accordance with SOP PR-TC-02.04.01.01 (**Worksheet #21** and **Attachment 2**).

Chain-of-custody Procedures

The chain-of-custody record will document the transfer of sample custody from the time of sample collection to laboratory receipt and will accompany the samples from the field to the analytical laboratory. A digital sample documentation/tracking program will be used during the execution of the work plan to provide additional confidence in sample recordkeeping and to add efficiencies to the process in accordance with SOP PR-TC-02.12.02.00 (**Worksheet #21** and **Attachment 2**).

When samples are transferred, both the individual relinquishing and the individual receiving the samples will sign, date, and note the transfer time on the COC record. The chain-of-custody records may consist of an original top copy and two carbonless copies, or the records may be in a pre-populated electronic format. When using the

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

carbonless chain-of-custody format, the original and first copies will be transmitted to the primary analytical laboratory with the samples. The second copy will be retained in project files for the Field Team Leader, Project Chemist, and Database Manager. Field personnel will sign and date the chain-of-custody forms prior to sealing the cooler and shipping the samples. Field personnel will make a copy of the signed form and scan a copy of each chain-of-custody record to be saved electronically in the project files.

The chain-of-custody record will be completed by each field sampling team using waterproof ink. Corrections will be made with a single line-out, the error will be initialed and dated, and then the correct information will be entered. Empty fields on the chain-of-custody record will be crossed out with a single line or "Z'd" out, with the date and signature entered by the field sampling team. If samples are to be delivered to the laboratory by an overnight courier, the commercial courier company and air bill number will be entered on the COC record as evidence of custody. The chain-of-custody records will be placed in a waterproof plastic bag and taped to the inside lid of the sample cooler prior to sealing with appropriate secure tape and custody seals. These requirements will be fulfilled by the field sampling personnel.

Custody Seals
Custody seals will be used when samples are shipped via commercial courier service and will be placed on the cooler so that the seals have to be broken before the cooler can be opened. The seals will be signed and dated by the field personnel.

Sample Packaging- Radiological Samples
Samples will be delivered for analysis to the laboratory via cooler, box, or other similar container (ice is not required if only radiological analyses will be performed), along with the completed COC. Samples to be sent off site will be packaged in accordance with applicable DOT and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage. Prepared packages will be surveyed prior to shipment.

Sample Packaging – Chemical Samples
Samples will be packaged and shipped in accordance with Gilbane SOP PR-TC-02.04.01.01, *Sample Handling, Packaging, and Shipping* (**Worksheet #21** and **Attachment #2**).

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):
Laboratory sample custody procedures include the receipt of samples, archiving, and disposal. Custody of samples will be maintained and custody transfer will be documented from the time of sample receipt through sample disposal by the

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

analytical laboratory.

The analytical laboratories will have established custody procedures, which include the following:

- Designation of a sample custodian
- Completion by the custodian of the chain-of-custody record, any sample tags, and laboratory request sheets, including documentation of sample condition upon receipt
- Laboratory sample tracking and documentation procedures
- Secure sample storage with the appropriate environment (e.g., refrigerated, dry), consistent with analytical method requirements
- Proper data logging and documentation procedures, including custody of original laboratory records

Upon arrival of the samples at the analytical laboratory, a sample custodian will take custody of the samples, assess the integrity of sample containers, and verify that the information on the sample labels matches the information on the associated chain-of-custody record. The laboratory will restrict access to the storage areas to authorized laboratory personnel only, to prevent unauthorized contact with samples, extracts, or documentation.

The sample custodian will maintain security of the samples in accordance with the analytical laboratory SOP. Samples will be retained by the laboratory for 90 days after final sample results are reported. Laboratory samples and any remaining field sample volume will be returned under chain-of-custody to HPNS for archiving (**Worksheet #26**).

SAP Worksheet #28 – Laboratory QC Samples Table

Matrix	Soil
Analytical Group	Gamma Spectroscopy
Analytical Method / SOP Reference[1]	EPA 901.1M/ ARS-007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank (MB)	Daily	Absolute Value < minimum detectable activity (MDC)	Recount the blank to confirm results unless all sample results are > 5 times the blank activity. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	Laboratory Chemist	Accuracy	Absolute value < MDC
Laboratory Control Sample (LCS)	1 per preparatory batch (defined as ≤ 20 samples)	Recovery percentage +/- 25%.	Recount the LCS to confirm results. Inspect LCS control chart for indication of significant bias. If required, reprep and reanalyze the LCS and all associated samples.	Laboratory technician	Accuracy	Recovery percentage +/- 25%.
Sample Duplicate	1 per preparatory batch (defined as ≤ 20 samples)	The Duplicate Error Ratio (DER) between the sample and sample duplicate shall be <3 and the relative percent difference (RPD) shall be ≤25%.	Check for lab error. If none found, narrate.	Laboratory chemist	Precision	The DER between the sample and sample duplicate shall be <3 or the RPD shall be ≤25%.

SAP Worksheet #28 – Laboratory QC Samples Table

Matrix	Soil
Analytical Group	Strontium
Analytical Method / SOP Reference[1]	USEPA 905.0 Modified/ ARS-032

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	Analytes < MDC	Recount the blank to confirm results unless all sample results are > 5 times the blank activity. If required, reprep and reanalyze MB and all samples processed with the contaminated blank	Laboratory Chemist	Accuracy	Analytes < MDC
LCS and/or Laboratory Control Sample Duplicate (LCSD)	1 per preparatory batch (defined as ≤ 20 samples)	75-125%	Recount the LCS to confirm results. Inspect LCS control chart for indication of significant bias. If required, reprep and reanalyze the LCS and all associated samples.	Laboratory Chemist	Accuracy	75-125%
Sample Duplicate	1 per preparatory batch (defined as ≤ 20 samples)	The DER between the sample and sample duplicate shall be <3 and the RPD shall be ≤25%.	Check for lab error. If none found, narrate.	Laboratory Chemist	Precision	DER between the sample and sample duplicate shall be <3 or the RPD shall be ≤25%.
Carrier	Every standard and sample	40-110%	Reanalysis of sample, including sample preparation. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Laboratory Chemist	Accuracy	40-110%

SAP Worksheet #28 – Laboratory QC Samples Table

Matrix	Soil
Analytical Group	Plutonium-239
Analytical Method / SOP Reference[1]	HASL 300M Pu-02-RCM / ARS-026

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	Analytes < MDC	Recount the blank to confirm results unless all sample results are > 5 times the blank activity. If required, reprep and reanalyze MB and all samples processed with the contaminated blank	Laboratory Chemist	Accuracy	Analytes < MDC
LCS and/or Laboratory Control Sample Duplicate (LCSD)	1 per preparatory batch (defined as ≤ 20 samples)	75-125%	Recount the LCS to confirm results. Inspect LCS control chart for indication of significant bias. If required, reprep and reanalyze the LCS and all associated samples.	Laboratory Chemist	Accuracy	75-125%
Sample Duplicate	1 per preparatory batch (defined as ≤ 20 samples)	The DER between the sample and sample duplicate shall be <3 and the RPD shall be ≤25%.	Check for lab error. If none found, narrate.	Laboratory Chemist	Precision	DER between the sample and sample duplicate shall be <3 or the RPD shall be ≤25%.
Carrier	Every standard and sample	30-110%	Reanalysis of sample, including sample preparation. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Laboratory Chemist	Accuracy	30-110%

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	VOCs
Analytical Method / SOP Reference[1]	EPA 8260B/ ARS-159

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	TPH
Analytical Method / SOP Reference[1]	EPA 8015M/ EMAX-8015G & EMAX-8015D

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method / SOP Reference[1]	8270D/ARS-160

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference[1]	EPA 8270SIM/ EMAX-8270SIM

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits to be listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PCBs
Analytical Method / SOP Reference[1]	EPA 8082A/ ARS-157

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Pesticides
Analytical Method / SOP Reference[1]	EPA 8081B/ EMAX-8081

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated prep batch if sufficient sample material is available, unless obvious chromatographic interference is present then notify and narrate.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table

Matrix	Soil
Analytical Group	pH
Analytical Method / SOP Reference[1]	EPA 9045D /ARS-146

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample Duplicate	One duplicate per batch, not to exceed 20 samples	QC acceptance criteria is within ± 0.10 pH units	Reanalysis or flag data as being outside control limits	Lab Manager / Analyst	Precision and Accuracy/Bias	QC acceptance criteria is within ± 0.10 pH units

SAP Worksheet #28 – Laboratory QC Samples Table

Matrix	Soil/Sediment
Analytical Group	PLM
Analytical Method / SOP Reference[1]	EPA 600/R-93/116 / SOP 109

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Friable Non-ACM blank	Daily, at beginning and end of day's work.	No asbestos fibers detected	Correct problem. If required, re-prepare and re-analyze Friable Non-ACM Blank and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	No asbestos fibers detected
Non-friable Non-ACM blank	Every 20 non-friable material samples	No asbestos fibers detected	Correct problem. If required, re-prepare and re-analyze Non-friable Non-ACM Blank and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	No asbestos fibers detected
Intra-analyst Duplicate	10% per month	Within one quantification range above or below that found on the initial analysis	Correct problem, then re-prepare and re-analyze all samples in the associated preparatory batch, if exceedance not caused by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Within one quantification range above or below that found on the initial analysis
Inter-analyst Duplicate	10% of Intra-duplicate analyses	Within one quantification range above or below that found on the initial analysis	Correct problem, then re-prepare and re-analyze all samples in the associated preparatory batch, if exceedance not caused by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Within one quantification range above or below that found on the initial analysis

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010D/6020B/7471B// ARS-166/ARS-155/ARS-152

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per preparatory batch (defined as ≤ 20 samples)	All analytes < ½ LOQ	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory technician	Accuracy	All analytes < ½ LOQ
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated prep batch for failed analytes if sufficient sample material is available.	Laboratory technician	Accuracy/ Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.	Check for lab error. If none found, narrate.	Laboratory technician	Accuracy/ Precision	Per DoD QSM/ laboratory limits as listed in Attachment 3 to this SAP.
Serial Dilution	Each new sample matrix	1:5 dilution must agree within ± 10% of original determination	Perform post-spike if serial dilution does not meet criteria.	Laboratory technician	Accuracy	1:5 dilution must agree within ± 10% of original determination

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010D/6020B/7471B// ARS-166/ARS-155/ARS-152

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion Spike	When serial dilution or matrix spike fails	75-125%	No specific corrective action	Laboratory technician	Accuracy	75-125%

WS #28 Footnotes:

[1]Analytical SOPs are provided in **Attachment 3** of this SAP.

SAP Worksheet #29 – Project Documents and Records Table

Document	Where Maintained[1]
Work Plan, which includes this SAP	Project file; NAVFAC SW Administrative Record
Field forms	Project file
Chain-of-custody forms	Project file; analytical laboratories; NAVFAC SW will receive copies of definitive data chain-of-custody records
Shipping Records	Project file
Audit/assessment checklists/reports	Project file and laboratory (if applicable)
Corrective action forms/reports	Project file and laboratory (if applicable)
Field change request forms	Project file
Analytical laboratory data packages (DoD Stage 4)	Laboratory and project file; NAVFAC SW Administrative Record
Data validation reports	Validator and project file; NAVFAC SW Administrative Record Validated electronic data will be loaded into Naval Installation Restoration Information Solution (NIRIS), the Navy's centralized database

Notes:
Active project files will be maintained by the PM until project completion. Following completion, Hardcopy files will be archived at Iron Mountain. The files will be stored for a minimum of 10 years at the following location:

Iron Mountain Headquarters
745 Atlantic Avenue
Boston, Massachusetts 02111
(800) 899-IRON

Documents submitted to the NAVFAC Southwest Administrative Record are located at:

Commanding Officer
Naval Facilities Engineering Command, Southwest
1220 Pacific Highway (NBSD Bldg. 3519)
San Diego, CA 92132

Following response complete at the facility, hardcopy deliverables will be archived by the Navy at a Federal Records Center (FRC) (http://www.archives.gov/frc/locations.html) where they are maintained for 50 years.

SAP Worksheet #30 – Analytical Services Table

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Soil	Radiochemistry	Samples as listed on SAP Worksheet #18	Gamma Spectroscopy, GFPC, Alpha Spectroscopy, Radon Emanation	30 calendar days	ARS 2609 North River Road Port Allen, LA 70767 Danielle Dittrich (225) 381-2991 ddittrich@aaanalytical.com	GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 (843) 556-8171 Valerie Davis (843) 556-8171 team.davis@gel.com
Soil	VOCs, SVOCs, PCBs, Metals, pH	Samples as listed on SAP Worksheet #18	Analytical groups as listed in SAP Worksheet #23	10 working days	ARS 2609 North River Road Port Allen, LA 70767 Danielle Ditrrich (225) 381-2991 ddittrich@aaanalytical.com	GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 (843) 556-8171 Valerie Davis (843) 556-8171 team.davis@gel.com
Soil	PAHs, TPH, Pesticides	Samples as listed on SAP Worksheet #18	Analytical groups as listed in SAP Worksheet #23	10 working days	EMAX 1835 W. 205th Street Torrance, CA 90501 Tel: 310-618-8889 X118 rbeauville@emaxlabs.com	GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 (843) 556-8171 Valerie Davis (843) 556-8171 team.davis@gel.com
Soil	Asbestos	Samples as listed on SAP Worksheet #18	EPA 600/R-93/116	10 working days	A&B Labs 10100 East Frwy, Ste 100 Houston, TX 77029 Alisha Hughes (713) 453-6060 x 127 alishar@ablabs.com	NVL Laboratories

SAP Worksheet #30 – Analytical Services Table

Samples will be analyzed by laboratories that are accredited to the DoD QSM for Environmental Laboratories version 5.3. (**Attachment 5**) Status of laboratory certifications/accreditations will be verified prior to fieldwork and before samples are delivered to lab. Updates to lab accreditation to ensure the laboratory is qualified to perform the analysis will be made prior to sample testing.

SAP Worksheet #31 – Planned Project Assessments Table

Assessment Type	Frequency	Internal or Exter-nal	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Operational Readiness Review (ORR)	Project Startup	Internal	Gilbane	Corporate RSO/CHP	PM Gilbane	PM Gilbane	RSO Envirachem
Field Sampling Surveillance	Annually; at least one technical systems audit (TSA) at the start of field activities, with discretionary follow-ups	Internal	Gilbane	PQCM (Gilbane)	PM (Gilbane)	PM (Gilbane)	PM and PQCM (Gilbane)
Data Review TSA	During Field Sampling and Analysis though validation	Internal	Gilbane	PM, Program Chemist (Gilbane)	PQCM (Gilbane), Analytical Laboratory Manager	Program Chemist (Gilbane), Analytical Laboratory Manager	Program Chemist (Gilbane)
Quality Assurance /Quality Control	Project startup through completion of field investigation	Internal	Gilbane	QCPM (Gilbane)	PM (Gilbane)	PM (Gilbane) QCPM (Gilbane)	QCPM (Gilbane)

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Time-frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time-frame for Response
ORR	ORR Checklist	PM, Gilbane	7 days after completion of report	Corrective Action Report	Project Manager and QCPM, Gilbane	5 days after notification
Field Sampling Surveillance	Audit form (See **Attachment 6**) showing results of field audit. If CAs are necessary and cannot be implemented during the audit, these deficiencies will be noted and their resolution will be documented in the CA report.	Site Superintendent, Gilbane	As soon as possible within same day of finding	Completed Audit Form indicating all CAs taken. Additional documentation will be attached as necessary.	Project Manager and QCPM, Gilbane	1 business day
		PM, Gilbane	1 business day		PM, Gilbane	1 business day
		Program Chemist, Gilbane	1 business day		Program Chemist, Gilbane	3 business day
		LRPM, Navy RPM, Navy	1 business day if CA involving > 1 day delay is necessary		LRPM, Navy RPM, Navy	Included with summary report
Data Review TSA	Memo or Written Report	Program Chemist, Gilbane	1 business day	Letter or email	Program Chemist, Gilbane	3 business days

SAP Worksheet #33 – QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
DQA • Provides an overview of sampling, decontamination, and data storage procedures • Identifies QC samples and summarizes associated analytical results • Summarizes the findings of the analytical data validation process • Provides an evaluation of data quality in accordance with the data quality indicator (DQIs) as defined in the SAP	Once for all data per parcel	Approximately 60 days after field investigation is complete	Program Chemist, Gilbane Corporate RSO/CHP, Gilbane	Navy LRPM Navy RPM
Laboratory Systems Audit	During DoD ELAP assessment or renewal of DoD ELAP certification	To be determined by DoD ELAP if offsite lab Audit/recertification is required	Accrediting Body Auditor	Accrediting Body POC Laboratory Quality Assurance Manager
Field Sampling TSA Report	Once	Approximately 30 days after completions of audit	QCPM, Gilbane	Navy LRPM Navy RPM

SAP Worksheet #34-36 – Data Verification and Validation (Steps I and IIa/IIb) Process

Data Review Input	Description	Responsible for Verification or Validation[a]	Step I/ IIa/IIb[a]	Internal/External[b]
Daily Activity Reports	Daily activity reports will be reviewed internally and placed into the project file for archival at project closeout.	Field Team Leader/Gilbane	Step I	Internal
Chains-of-Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody will be initialed by the reviewer, a copy of the chains-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment. Chains-of-custody will also be reviewed for adherence to the SAP by the project chemist.	Field Team Leader/Gilbane Project Chemist/Gilbane	Step I	Internal & External
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project chemist in the form of laboratory logins.	Project Chemist/Gilbane	Step I	External
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Project Chemist/Gilbane	Step I	External
Electronic Data Deliverables	Electronic Data Deliverables (EDDs) will be compared against hardcopy laboratory results (10 percent check). Discrepancies will be resolved with the laboratory.	Project Chemist/Gilbane	Step I	External
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process. This is verification that they were generated and applicable to the data packages.	Data Validator/Gilbane	Step I	External
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Respective Laboratory QAO	Step I	Internal
Laboratory Data	The data will be verified for completeness by the project chemist. In order to ensure completeness, EDDs will be compared to the SAP. This is a verification that all samples were included in the laboratory data and that correct analyte lists were reported.	Project Chemist/Gilbane	Step I	External
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the site manager will be notified to ensure action is taken.	PM/Gilbane Project Chemist/Gilbane	Step I	Internal
Corrective Action Reports	Corrective action reports will be reviewed by the project chemist or PM and placed into the project file for archival at project closeout.	PM/Gilbane Project Chemist/Gilbane	Step I	External
Laboratory Methods	During the pre-validation check, ensure that the laboratory analyzed samples using the correct methods specified in the UFP-SAP. If methods other than those specified in the SAP were used, the reason will be determined and documented.	Project Chemist/Gilbane	Step IIa	External
Target Compound List and Target Analyte List	During the pre-validation check, ensure that the laboratory reported all analytes from each analysis group in accordance with **Worksheet #15**. If the target compound list is not correct, then it must be corrected prior to sending the data for validation. Once the checks are complete, the PM is notified via e-mail.	Project Chemist/Gilbane	Step IIa	External
Reporting Limits	Ensure the laboratory met the project-designated QLs shown in **Worksheet #15**. If QLs were not met, the reason will be determined and documented.	Project Chemist/Gilbane	Step IIb	External
Field SOPs	Ensure that all field SOPs were followed.	Field Team Leader/Gilbane	Step I	Internal
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Respective Laboratory QAO	Step I	Internal

SAP Worksheet #34-36 – Data Verification and Validation (Steps I and IIa/IIb) Process (Continued)

Data Review Input	Description	Responsible for Verification or Validation[1]	Step I/ IIa/IIb[1]	Internal/External[2]
Laboratory Data	A compliance check will be performed to compare the documented receipt conditions and analytical QC results in the data package to acceptance criteria this SAP and validation guidelines referenced in **Worksheet #14**.	Data Validator/Synectics	Step IIa	External
Raw Data	20 percent review of instrument outputs and recalculation checks of raw data to confirm identifications and laboratory calculations. For a recalculated result, the data validator attempts to re-create the reported numerical value. The laboratory is asked for clarification if a discrepancy is identified which cannot reasonably be attributed to rounding. In general, this is outside 5 percent difference.	Data Validator/Synectics	Step IIa	External
Onsite Screening	All non-analytical field data will be reviewed against SAP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader/Gilbane	Step IIb	Internal
Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Data Validator/Synectics	Step IIa	External
Documentation of Field QC Sample Results	Establish that all required QC samples were run and met limits.	Project Chemist/Gilbane	Step IIa	Internal
DoD ELAP Evaluation	Ensure that each laboratory is DoD ELAP Certified for the analyses they are to perform. Ensure evaluation timeframe does not expire.	Project Chemist/Gilbane	Step I	External
Analytical data for radiological parameters in all samples.	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. Data may be qualified if QA/QC exceedances have occurred and is summarized in Gilbane SOP PR-TC-04010200 (Worksheet #21 and Attachment #2). The following documents will be used as guidance for validating chemical analytical results: General Data Validation Guidelines (DoD, 2019) and published modules supplemented by Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, EPA 540-R-2017-002 (EPA, 2017) and Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, EPA 540-R-2017-001 (EPA, 2017). Radiological analytical results will be validated using the QC criteria specified in the SAP, QSM v. 5.3 (DoD/DOE, 2019), and Chapter 8 of the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), EPA 402-B-04-001A (EPA et al., 2004). Of the analytical data, 100 percent will be validated by a third-party data validation subcontractor, with 20 percent of the sample delivery groups subject to Stage 4 validation and 80 percent subject to Stage 2B validation. Stage 4 data validation follows the DoD General Validation Guidelines (DoD, 2019). These guidelines apply to analytical data packages that include the raw data (e.g., spectra and chromatograms) and backup documentation for calibration standards, analysis run logs, laboratory control samples (LCSs), dilution factors, and other types of information. This additional information is used in the Stage 4 data validation process for checking calculations of quantified analytical data. Calculations are checked for QC samples (e.g., matrix spike [MS]/matrix spike duplicate [MSD] and LCS data) and routine field samples (including field duplicates, matrix spikes and duplicates where applicable). To ensure that detection limit and data values are appropriate, an evaluation is made of instrument performance, method of calibration, and the original data for calibration standards. Under the Stage 2B data validation effort, the data values for primary and QC samples are generally assumed to be correctly reported by the laboratory. Data quality is assessed by comparing the QC parameters listed in the previous paragraph to the appropriate criteria (or limits) as specified in this SAP, by DoD-QSM v5.3 requirements, or by method-specific requirements (e.g., EPA, DOE). If calculations for quantitation are verified, it is done on a limited basis and may require raw data in addition to the standard data forms normally present in a data package.	Data Validator/Synectics	Step IIa and IIb	External

Notes:

[1] Verification (Step I) is a completeness check that is performed before the data review process continues in order to determine whether the required information (complete data package) is available for further review. Validation (Step IIa) is a review that the data generated is in compliance with analytical methods, procedures, and contracts. Validation (Step IIb) is a comparison of generated data against measurement performance criteria in the SAP (both sampling and analytical). Should Gilbane find discrepancies during the verification or validation procedures above, an e-mail documenting the issue will be circulated to the internal project team, and a Corrections to File Memo will be prepared identifying the issues and the CA. This Memo will be sent to the laboratory, or applicable party, and maintained in the project file.

[2] Internal or external is in relation to the data generator.

SAP Worksheet #34-36 – Data Verification and Validation (Steps I and IIa/IIb) Process (Continued)

Table 34_36-1. Data Validation Guidance for Data Qualification

Quality Control Check	Evaluation	Data Qualification	Samples Affected
Holding Time	Holding time exceeded for extraction, digestion, or analysis	J = positive results; Nondetects = use professional judgment – UJ or R	All analytes in sample
Sample Preservation	N/A	None required	
Temperature	N/A	None required	
ICAL (See **Worksheet #24** for criteria)			
Energy	Energy difference outside criteria	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	Associated analytes in all samples in analytical batch
Efficiency	Efficiency difference outside criteria	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
FWHM peak resolution	FWHM peak resolution outside criteria	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
ICV	Observed peaks in ICV greater than 10% of ICAL value	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	Associated analytes in all samples in analytical batch
CCV (Daily Check)	Energy, efficiency, or FWHM outside criteria	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	Associated analytes in all samples in analytical batch
BSC	Background count rate of entire spectrum > 3σ of the average	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	All associated samples in analytical batch
ICC	Background count rate of entire spectrum > 3σ of the average	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	All associated samples in analytical batch
LCS	%R >UCL	Sample > MDC; qualify as estimated (J) Sample < MDC; None required	Associated analytes in all samples in preparation batch or analytical batch
	%R <LCL but ≥ 30%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
	%R <30%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as unusable (R)	
Method Blank	Blank < MDC	None required	Associated analytes in all samples in preparation batch or analytical batch
	Blank > MDC	Sample < MDC; None required Sample > MDC by < 10x blank; qualify as estimated (J) Sample > 10x blank; None required	
Tracer Recovery (alpha spectroscopy only) Carrier Recovery (GFPC ony)	%R >UCL	Sample > MDC; qualify as estimated (J) Sample < MDC; None required	Associated analytes in affected samples
	%R <LCL but ≥ 10%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
	%R <10%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as unusable (R)	

SAP Worksheet #34-36 – Data Verification and Validation (Steps I and IIa/IIb) Process (Continued)

Table 34_36-1. Data Validation Guidance for Data Qualification

Quality Control Check	Evaluation	Data Qualification	Samples Affected
Laboratory Control Sample Duplicates	Concentration of reported analytes are > 5x the MDC in either sample and RPD ≥ 25% and/or RER ≥ 1	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	Analytes in parent sample
	Concentration of reported analytes are < 5x the MDC in either sample and absolute difference > 3x MDC	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
Matrix Spike[1]	%R >UCL	Sample > MDC; qualify as estimated (J) Sample < MDC; None required	Associated analytes in all samples in preparation batch or analytical batch
	%R <LCL but ≥ 30%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	
	%R <30%	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as unusable (R)	
Field Duplicates	Concentration of reported analytes are > 5x the MDC in either sample and RPD ≥ 25% and/or RER ≥ 1	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	Analytes in parent sample and field duplicate
	Concentration of reported analytes are < 5x the MDC in either sample and absolute difference > 3x MDC	Sample > MDC; qualify as estimated (J) Sample < MDC; qualify as estimated (UJ)	

Notes:
< = less than
> = greater than
All QA/QC criteria are included in **Worksheets #12, #24**, and **#28** and will be used for validation criteria.
[1]If activity of the sample > 5 times the spiking level.
%R = percent recovery
LCL = lower control limit
UCL = upper control limit

SAP Worksheet #37 – Usability Assessment

The DQO for the project include the following goals:

- To evaluate and document the validity of the obtained radiological data to support decisions
- To corroborate prior survey results if necessary
- To compare radiological data to RGs
- To compare radiological data to applicable natural background values
- To recommend additional remediation if necessary

Assessment of sampling and survey data consists of four separate and identifiable phases: data reduction, data verification, data validation, and DQA. These processes will be performed in accordance with MARLAP (USEPA et. al, 2004) and other applicable guidance. Data reduction involves data transformation processes such as converting raw data into reportable quantities and units, using significant figures, and calculating measurement uncertainties. Verification and validation pertain to evaluation of survey and analytical data and are considered as two separate processes.

Data verification compares the survey and sampling data collection against the requirements of the project-specific Work Plan and SOPs. For example, the actual survey locations, number and location of systematic static survey measurements, and the number and location of swipe samples will be compared with the planned survey activities. A verification report may be prepared depending on the size and complexity of the survey. The verification report identifies those requirements that were not met (called exceptions). Task-specific verification checklists will be developed in accordance with MARLAP Section 8.5 prior to field mobilization to ensure that requirements identified in the work planning documents are met. Data verification also involves reviewing data that was transcribed or transferred into the electronic data management systems. The data verification will be performed by the Corporate RSO/CHP and other senior staff with access to the original data, SOPs, and the Parcel B Work Plan.

At HPNS, the verification process will include the following:

- Appropriate selection of the survey instruments
- Appropriate survey methods for the ROCs
- Evaluation of data completeness
- Verification of instrument/detector calibration
- Daily response checks of the instrument/detector
- Assessment of survey method specifications, including distance from the detector to surveyed surface, survey path, time that counts are collected, and adherence to operator response requirements, such as response to measurements exceeding the investigation level and documentation of adverse conditions
- Retrospective calculation of MDCs

SAP Worksheet #37 – Usability Assessment (Continued)

- Adjustments of background count rate settings
- Checks on instrument system performance
- Swipes collected as required: labeling, analyses, and documentation
- Recorded measurement and sample locations per project requirements

Validation is a systematic check on the set of survey or analytical data being used to meet the project requirements and is performed to addresses the usability of the data. The validation process begins with a review of the survey or analytical data package to identify its areas of strength and weakness. The validation process should determine the impact of not meeting the requirements of the Parcel B Work Plan and SOPs. Validation then evaluates the data to determine the absence of a required survey measurement and the uncertainty of the survey process. During validation, the technical reliability and the degree of confidence in the reported survey data are considered. The validator will note if data that do not meet the performance criteria (**Worksheet #28**). The products of the validation process are validated data and a statement on which data are acceptable and which data are sufficiently inconsistent that it should not be used in the decisions for which the survey data was collected.

The DQA is the last phase of the data collection process and consists of a scientific and statistical evaluation of project-wide knowledge to assess data usability. DQA considers all sampling, analytical, and data handling details, external QA assessments, and other historical project data to determine the usability of data for decision-making. To assess and document overall data quality and usability, the data quality assessor integrates the data validation report, field information, assessment reports, and historical project data, and compares the findings to the DQOs objectives defined in the Parcel B Work Plan and this SAP. The DQA process uses the combined findings of these multi-disciplinary assessments to determine data usability for the intended decisions, and to generate a DQA report documenting that usability and the causes of any deficiencies.

The DQA process varies depending on the survey objectives, and the level and depth of the verification. The process will evaluate and document the usability of the data by considering the project DQIs, which are precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). The DQA process will determine whether the data will be suitable for the intended needs of the project. Every data type (e.g., sampling, field screening data, and laboratory analytical data) will be relevant to the usability assessment. Data usability will include the review of analytical data validation flags, applied by the third-party analytical data validation subcontractor, to the project data, as well as an assessment by the project team of any "X"-flags to determine if the associated data should be rejected or qualified as estimated in accordance with the *General Data Validation Guidelines* (DoD, 2019b). Also included in the DQA will be an overall assessment of the analytical data and field QC samples.

The assessment will consider the relationship of each type of data to the entire data set, and the adequacy of the data to fulfill the project DQOs. The data will be assessed for correctness, completeness, and compliance to method- or project-specific QA/QC requirements, including the results of the independent analytical data validation process

SAP Worksheet #37 – Usability Assessment (Continued)

and contractual requirements. Analytical data validation will evaluate the data based on the PARCCS criteria defined in this SAP and other method-specific performance requirements. The overall assessment process will also evaluate data usability based on the intended use of the data. The intent of the DQA process will be to establish the PARCCS levels and usability of the final results with respect to the project DQOs. Upon completion of analytical data validation, each data point will be assessed as non-qualified, qualified as estimated ("J" or "UJ" qualified), or qualified as rejected ("R" qualified) based upon the acceptance criteria, and analytical data validation flags will be added to the project data. These parameters will be based on the analytical data quality and will encompass the DQIs established in this SAP. Qualification will be given according to each sample's delivery group and will be based on the SAP and applicable laboratory and data validation SOPs. Both analytical and contractual compliance and completeness levels will be assessed for each analytical parameter. Finally, the overall usefulness of the data will be established as related to the project DQOs.

Data Quality Indicators

Quantifiable criteria, known as measurement performance criteria, are presented in **Worksheet #12**. The PARCCS criteria will be the qualitative and quantitative indicators of data quality. The PARCCS criteria are defined and discussed as follows.

Precision

Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions. It will be expressed in terms of the RPD as follows:

[EMBED Equation.3]

where: A = First duplicate concentration
B = Second duplicate concentration

For the evaluation of precision between the native sample and its associated duplicate, the sample results must be greater than 5 times the MDC in order for the RPD criteria (see **Worksheet #12**) to apply. When either the sample or duplicate results are less than 5 times the MDC, then the DER must be less than 3 using the following equation.

$$DER = \frac{|(S-D)|}{\sqrt{(CSUs)^2 - (CSUd)^2}} = \text{—}$$

SAP Worksheet #37 – Usability Assessment (Continued)

where: S = Sample result
D = Duplicate (or lab replicate) result
CSUs = Combined standard uncertainty of the sample
CSUd = Combined standard uncertainty of the duplicate
DER = Duplicate error ratio

If either the RPD or RER fail the criteria, the native sample and field duplicate results will be qualified as estimated ("J" flag). Other site-specific field duplicate and laboratory duplicate results will be evaluated for trends and if the exceedance is due to the sample matrix or field sample collection, as well as if resampling is warranted. This evaluation and any impact related to ROCs will provided in the DQA.

Accuracy
Accuracy is the degree of agreement of an observed measurement (or an average of the same measurement type) with an accepted reference or true value. Accuracy of analytical determinations will be measured using laboratory QC analyses such as LCSs and surrogate spikes. Accuracy will be measured by evaluating the actual result against the known concentration added to a spiked sample and will be expressed as %R as shown below:

[EMBED Equation.3]

where:

S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike

Representativeness
Representativeness is the reliability with which a measurement or measurement system reflects the true conditions under investigation. Representativeness is influenced by the number and location of the sampling points, sampling timing and frequency of monitoring efforts, and the field and laboratory procedures. The representativeness of data will be maintained by the use of established field and laboratory procedures and their consistent application.

Comparability
Comparability expresses the confidence with which one data set can be compared to another based on using USEPA-defined procedures, where available. If USEPA procedures are not available, the procedures have been defined or referenced in this SAP.

SAP Worksheet #37 – Usability Assessment (Continued)

The comparability of data will be established through well documented methods and procedures, standard reference materials, QC samples, performance-evaluation study results, and by reporting each data in consistent units.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Analytical data validation and DQA will determine which data will be valid and which data will be rejected. Percent completeness will be defined as follows:

$$\text{Percent Completeness} = (V / T) \times 100$$

where:

V = Number of valid (not rejected) measurements over a given time
T = Total number of planned measurements

The completeness goal for this project is 90 percent for valid, usable data. If the completeness goal of the project is not achieved, a discussion of the limitations on the use of the project data will be included in the Usability Assessment section of the DQA.

Sensitivity

Sensitivity is the measure of a concentration at which an analytical method can positively identify and report analytical results. The sensitivity of an analytical method will be indicated by the project-required reporting limits, as compared to the RGs and background.

Detection and Quantitation Limits

The decision level concentration (DLC) is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 95% confidence. At the DL, the false positive rate (Type I error) is 5%. A DLC may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 95% confidence. Although a result at or above the DL indicates that the analyte is present, the absence of a result at or above the DL is inconclusive (i.e., one cannot confidently state whether the analyte is present or absent), because the false negative rate if the analyte is present at the DL is 50%

The MDC is defined as the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 95% confidence. At the MDC, the false negative rate (Type II error) is 5%. In other words, if a sample has a true concentration at the LOD, there is at least a 95% probability of reporting a "detection" (a measured value ≥ DLC) and a 5% chance of falsely reporting a non-detect (a false negative).For this project, concentrations below the MDC will be reported as "U" to the MDC.

SAP Worksheet #37 – Usability Assessment (Continued)

The DL, limit of detection (LOD), and LOQ will be evaluated by the project team prior to sample analysis to determine if the laboratory is able to attain the required sensitivity for the project. If project decision limits are too sensitive, it will be determined prior to sample analysis whether a sensitivity variance will be issued to the laboratory based on the method chosen and the technology available.

The DL is the minimum quantity of an analyte that can be reliably distinguished from background noise or from zero for a specific analytical method at a 99 percent confidence level. The DL protects against false positives. The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99 percent confidence level that the value is not a false negative. The LOD should be equivalent to the concentration of the DL verification standard. The LOQ represents the smallest quantity of an analyte that can be accurately and reproducibly quantified in a given sample matrix (e.g., three to five times the LOD). The LOD will be used to determine if no detectable amounts of contaminants of concern are present. The DL will be used to determine if any detectable amounts of contaminants of concern are present. Any detections falling between the DL and LOQ are qualified as estimated.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

The usability assessment process will consist of reviewing the analytical data validation reports for usable analytical data (i.e., no validation qualifications or estimated "J"/"UJ" qualifications) and rejected ("X" qualified) analytical data, as well as evaluating the fieldand analytical data for discrepancies or deviations. This assessment will evaluate the impact of the discrepancies or deviations on the usability of the data and assesses whether the necessary information has been provided for use in the decision-making process. The assessment will evaluate whether there were deviations in sampling activities (e.g., incorrect sample location, improper or malfunctioning sampling equipment, or incorrect analysis performed), chain-of-custody documentation, or holding times; compromised samples (i.e., damaged or lost samples) and the need to resample; or changes to SOPs or methods that could potentially affect data quality.

An evaluation of QC sample results will be performed to assess whether unacceptable QC results (e.g., blank contamination) affect data usability. Other parameters to be evaluated during the usability assessment may include, but will not be limited to, the following:

- Matrix effects—matrix conditions that might have affected the performance of the extraction or analytical method
- Site conditions—unusual weather conditions or site conditions that might have affected the sampling plan
- Identifying critical and noncritical samples or target analytes

SAP Worksheet #37 – Usability Assessment (Continued)

- Background or historical data
- Data restrictions—data that do not meet the project DQOs or were "R" qualified might be restricted, but usable, as qualitative values for limited decision-making purposes

Identify the personnel responsible for performing the usability assessment:

Program Chemist, Gilbane

Data Validation Subcontractor, Synectics

RSO, Envirachem

The project team will be consulted as appropriate to determine final usability of the collected data.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented, so that they identify trends, relationships (correlations), and anomalies:

DQA/Data Usability Assessment will be reported in the Confirmation Survey Report. The data will be evaluated for overall PARCCS criteria for each matrix, analytical group, and concentration level, and data use limitations will be discussed in the DQA/Data Usability Assessment Reports for data that do not meet the project DQOs or DQIs. The DQA/Data Usability Assessment reports will include a detailed discussion of the data usability evaluations with sufficient information to support the data usability conclusions, such as the following:

- a detailed description of the regulatory requirements and technical bases for assessment
- review of data reduction, verification and validation
- assessment of trends and biases
- equilibrium of radionuclide decay chains
- analysis of environmental radioactivity
- variations of natural radionuclides
- satisfaction of quality objectives
- overall defensibility and usability
- appropriate analysis to support usability.

The level of data verification, validation, and DQA performed on radiological samples is defined in **Worksheet #34-36**. Copies of surveys, sampling, and analytical data (and their supporting data) will be protected and maintained in project record files.

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FIGURES

ATTACHMENT 1
Project Kickoff Meeting Minutes

DCN: GLBN-0005-5364-0003

ATTACHMENT 2
Gilbane Standard Operating Procedures

DCN: GLBN-0005-5364-0003

ATTACHMENT 3
DoD QSM Laboratory Limits

DCN: GLBN-0005-5364-0003

ATTACHMENT 4
Laboratory Standard Operating Procedures

DCN: GLBN-0005-5364-0003

ATTACHMENT 5
Laboratory DoD ELAP Certificates

ATTACHMENT 6
Technical Systems Audit Checklist

DCN: GLBN-0005-5364-0003